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THE

HEMICAL WORKS

OF

CASPAR NEUMANN, M. D.

THE

HEMICAL WORKS

OF

Literary Society of Bombay 2

ASPAR NEUMANN, M.D.

Profeſſor of Chemistry at Berlin, F. R. S. &c.

BRIDGED and METHODIZED;

WITH

LARGE ADDITIONS,

CONTAINING THE LATER

ISCOVERIES and IMPROVEMENTS

MADE IN

CHEMISTRY,

And the Arts depending thereon.

y WILLIAM LEWIS, M.B. F.R.S.

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SECOND VOLUME.

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PART II.

CHEMICAL HISTORY

OF THE

VEGETABLE KINGDOM.

SECTION II.

Of VEGETABLE JUICES.

CLASS I.

GUMS.

Gums.

Tragacanth.

THE ſtrongeſt Gum is that called, from the Tragacanth or Goats-thorn tree which produces it, Gum Tragacanth, and corruptly Dragant. The Goats-thorn is a prickly, papilionaceous flowered tree, growing in the iſland Candy and other parts of Aſia, near Aleppo in Syria, in Cilicia, on the ſea-coaſts about Marſeilles, &c. In Candy, the gummy juice begins to exude about the latter end of June: Tournefort has given a Copper-plate repreſenting its ſucceſſive protruſion, and the manner of its concretion: It proves more or leſs pure, of a whiter or darker colour, according to the weather after its exudation, and the accidental admixture of duſt.

The beſt Gum Tragacanth is in white, light, ſmooth, tranſparent, vermicular tears or ſtriæ, of a ſweetiſh taſte, without any ſmell. A yellowiſh or browniſh colour, though an imperfection in the drug, is not a mark of its being impure. The very whiteſt Gum

Gums.

becomes dark-coloured, barely by being diſſolved in pure diſtilled water, and exſiccated again by a gentle warmth: Some report, that it ſuffers the ſame change on being long kept. It diſſolves totally in water: Spirit of Wine extracts only about half a ſcruple out of an ounce. It gives over nothing in diſtillation either to water or to ſpirit, both the liquors ariſing unchanged. It is difficultly reducible into powder, unleſs it be thoroughly dried, and the mortar heated; or in winter, when ſtrong froſts have rendered the Gum hard and brittle.

Gum Tragacanth is made uſe of for faſtening down dry ſpecimens of plants upon paper, in making artificial flowers, in dying ſilks, and for the other more curious mechanic purpoſes, where a ſtrong and a fine Gum is required, whether for conglutinating, ſtiffening, or brightening. In medicine, it is employed for giving tenacity to powders, ſo as to fit them for being made into troches and other like forms: In electaries it is improper, as it renders them too ſlimy upon keeping. Tough coheſive ſubſtances, as Agaric and Colocynth, are made pulverable by beating them with a mucilage of Gum Tragacanth, [illegible] then drying the maſs. With regard to the vir[illegible] this and other Gums, they ſoften and thicken [illegible]monious thin juices; and hence their uſe in fluxes [illegible] in ſome kinds of coughs and other diſorders of the breaſt: In coughs where thick phlegm abounds, they are rather hurtful than beneficial (*a*).

CLASS

(*a*) *Gum Tragacanth.*] This differs from all the other gummy ſubſtances hitherto known, in giving a thick conſiſtence to a much larger quantity of water, and being much more difficultly, or rather not at all perfectly diſſoluble. Put into water, it ſlowly imbibes a large quantity of the liquid, ſwells into a large volume, and forms a ſoft but not fluid Mucilage. If the quantity of water is more than the Gum can imbibe, the Mucilage forms an irregular maſs, which does not mingle with the reſt of the water on ſtanding for many days, but unites or diſſolves by ſlight agitation: The ſolution has a wheyiſh or turbid appearance; and on ſtanding for a day or two, the Mucilage ſubſides again, the limpid water on the ſurface retaining little of the Gum.

Gum Arabic, Gum Senegal, and the Gums of the European Plum and Cherry-trees, ſeem to be but little different from one another. The Senegal is ſuppoſed to be the ſtrongeſt, and the Arabic the fineſt Gum. Gum Senegal, brought from the iſland of that name on the coaſt of Africa, commonly ſupplies the place of Arabic in the ſhops, and is the ſort chiefly employed by the callico printers, and in other buſineſſes where

Gums

CLASS II.

RESINS

Resins. OF the reſinous juices of vegetables, there are ſome which exude ſlowly, and after their exudation ſoon concrete upon the tree into ſolid tears or maſſes, of various figures and magnitudes. Others iſſue more copiouſly, retain their fluidity longer, and are commonly brought to us in their liquid ſtate, under the name of balſams (*b*).

Balsams. Balſams diſſolve, like the ſolid Reſins, in rectified Spirit of Wine, moſt readily in ſuch as is impregnated with fixed alcaline Salt. They mingle with all eſſen-

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Gums are made uſe of: It is generally in larger maſſes than the other, and of a darker yellowiſh or browniſh colour. All theſe are nearly pure Gums: They readily and perfectly diſſolve in water into a limpid liquor, and do not ſeparate from it upon ſtanding; On inſpiſſating the ſolutions, the exſiccated Gums prove, like Gum Tragacanth treated in the ſame manner, conſiderably darker coloured than at firſt.

It is obſervable that Gum Arabic and Gum Tragacanth are very little diſpoſed to unite with one another. When diſſolved in water and mixed together, the Gum Tragacanth ſeparates in a much ſhorter time than when diſſolved by itſelf; and this whether the ſolutions be thick or diluted largely with water.

(*b*) *Reſins.*] It is ſuppoſed, and with great probability, that Balſams and Reſins, are no other than vegetable Oils of the ſubtile or the groſs kind, ſomewhat altered by the intimate admixture of a vegetable acid and perhaps an over-proportion of earthy matter, or deprived of their more volatile and watery parts.

Some of the chemical writers, particularly Mr. Macquer, imagine mineral Bitumens alſo to be of the ſame origin; to be no other than vegetable Reſins, ſomewhat altered by the admixture of mineral acids in the earth. This opinion though it appears ſpecious from the conſiderations brought in ſupport of it, is built perhaps upon too ſlight foundations.

Mineral Bitumens are very different in their qualities from vegetable Reſins, and in the mineral kingdom we find a fluid Oil, very different from vegetable Oils. The mineral Oil is changed by mineral acids into a ſubſtance greatly reſembling Bitumen; and the vegetable Oils are changed by the ſame acids into ſubſtances greatly reſembling the natural Reſins. From Bitumens we gain by diſtillation the mineral Oil, and from Reſins the vegetable Oil, diſtinct in their qualities as at firſt. Vegetable Oils and Reſins have been treated with all the known mineral acids, but have never yielded any thing ſimilar to the mineral Bitumens. It ſeems therefore, as if the oily products of the two kingdoms were ſpecifically and eſſentially different. The laws of chemical enquiries, at leaſt demand that we do not look upon them any otherwiſe, till we are able to produce from one a ſubſtance ſimilar to the other. When this ſhall be done, and not before, the preſumptions that nature effects the ſame change in the bowels of the earth, will be of ſome weight.

RESINS.

tial Oils, though with one more readily than with another. By trituration with Almonds, Piſtachio nuts, Hazel nuts, and other like unctuous farinaceous kernels, they become miſcible with water into an emulſion or milky liquor. Yolk of eggs alſo renders them ſoluble in water; and ſugar ſtill more elegantly (c). In diſtillation with water they yield, ſome a large, and others a ſmall quantity of eſſential Oil, a ſolid brittle Reſin remaining behind in the ſtill.

OPOBALSAM.

The moſt precious of the Balſams is that commonly called OPOBALSAM, or Balm of Gilead, *Opabalſamum*, *Balſamelæon*, *Balſamum verum Album*, *Ægyptiacum*, *Judaicum*, *Syriacum*, *Gileadenſe*, *è Mecca*, &c. This is the produce of certain trees, which grew formerly in the valley of Jericho, but after the conqueſt of the Holy Land by the Turks, were removed to Grand Cairo, where the Balſam plantation is ſaid to be now guarded by Janiſſaries, and the reſinous juice collected for the Sultan only.

We are not to imagine, that what is ſold by the druggiſts under the name of this balſam, at no very great price, is the true Egyptian ſort: It is either the native juice of another kind of tree; or what is more probable, a compoſition of Balſam of Copaiba with diſtilled Oils, &c. Hence we meet with Opobalſams very different from one another, or agreeing only in external appearance. The only ſpecimen of the genuine Egyptian Balſam that I have ever ſeen, was one in the Royal Apotheca at Dreſden, received by King Auguſtus among other preſents, from the Grand Signior himſelf. An Arabian Balſam, left in our own repoſitory by my predeceſſor Gundelſheim, who had probably procured it in Arabia or at Conſtantinople, where he travelled with Tournefort, comes the neareſt to the above. The

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(c) *Balſams rendered miſcible with water by Sugar*, &c.] Balſams, like eſſential Oils, are ſtill more elegantly diſſolved in water by the intervention of Gums and Mucilages; and the ſolutions obtained by the means of theſe are likewiſe the moſt permanent. Gum is the medium employed by nature herſelf for uniting the oily, [illegible] and balſamic juices of vegetables with the watery; the medium, which enables water to extract by infuſion, the flavour of aromatic herbs. Gum Tragacanth renders Oils and Balſams miſcible with water, as well as the more ſoluble Gums; but the ſolutions made by the former are leſs permanent than thoſe made by the latter.

OPOBALSAM.

The true Balſam is of a pale yellowiſh colour, clear and tranſparent, about the conſiſtence of Venice Turpentine, of a ſtrong, penetrating, agreeable, aromatic ſmell, and a ſlightly bitteriſh pungent taſte: By age it becomes yellower, browner and thicker, loſing by degrees, like eſſential Oils, ſome of its finer and more ſubtile parts. To ſpread, when dropt into water, all over the ſurface, and to form a fine, thin, rainbow-coloured cuticle, ſo tenacious that it may be taken up entire by the point of a needle, were formerly infallible criteria of the genuine Opobalſam. I have obſerved, however, that other Balſams, when of a certain degree of conſiſtence, exhibit theſe phænomena equally with the Egyptian (*d*).

(*d*) *Balſam of Gilead.*] This Balſam according to Proſper Alpinus, is obtained from a ſmall Evergreen-tree or Shrub, about the ſize of the Privet or *Cytiſus*, with flexible branches and a few leaves, which reſemble thoſe of Rue or rather of the Lentiſk-tree, ſet in pairs along a middle rib, with an odd one at the end. The branches is covered with two membranous thin barks, the outermoſt of a reddiſh-brown colour, the inner greeniſh; the woody part is white. The flowers are of a purpliſh white colour, in ſhape like thoſe of Acacia: The fruit is a ſmall reddiſh black berry, containing yellow ſeeds.

The wood is ſaid to be inodorous, the bark fragrant and aromatic, the flowers highly odoriferous; the berries to be odorous, acrid and bitter, and to yield a yellow liquor of the appearance of honey. The branches and dry berries have been ſometimes brought into Europe, and kept in the ſhops for medicinal uſe, the former under the name of *Xylobalſamum*, the latter of *Carbobalſamum*: Whatever ſmell or taſte theſe ſubſtances may have when freſh, they have little of either as they come to us.

The precious Balſam exudes in very ſmall quantities, from ſlight inciſions made in the bark. According to the author above-mentioned, it is at firſt white, of a very ſtrong penetrating ſmell, of the Turpentine kind, but ſweeter and more fragrant, and of a bitter, acrid, aſtringent taſte. It looks in part turbid and thick, like the Oil newly expreſſed from Olives: Afterwards it grows extremely thin, limpid and light; its colour changes to a greeniſh, then to a Gold yellow, and by long keeping, to that of honey; it now grows thick like Turpentine, and loſes much of its fragrance.

Inferior ſorts of Balſam are ſaid to be obtained by boiling the branches in water: When the liquor begins to boil, a thin Oil ariſes to the ſurface, and on continuing the coction a groſſer and a thicker one.

Mr. Geoffroy obſerves, that a ſolution of Balſam of Gilead made in Spirit of Wine, turns milky on being poured into water, but does not depoſite any Precipitate; and that this mixture is uſed in France as a coſmetic. He ſays an equal quantity of Oil of Almonds is previouſly mixed with the Balſam; but this ingredient can be of no uſe, as it totally ſeparates and falls to the bottom whilſt the Balſam diſſolves in the Spirit.

II. Balsam of Tolu.

BALSAM OF TOLU is commonly of a thicker conſiſtence than the foregoing, and more of a browniſh colour: When freſh, it has an exceeding pleaſant ſmell, ſomewhat reſembling that of Citrons. It is ſaid to be the produce of New Spain, and to exude in very hot weather, from inciſions made in the bark of a ſmall tree of the Fir kind, called Tolu (*e*).

III. Balsam of Copaiba.

BALSAM OF COPAIBA, *Copbabu*, *Copaif*, *Campaif*, *Copaliva*, or *Gamelo*, is obtained from a tree of the ſame name, growing in the Brazils, near the Rio de Janeiro, in Fernambuco, and St. Vincent's. It is of a pale yellowiſh colour, and thin conſiſtence. It is obſervable, that on mixing this juice with the watery Spirit of Sal ammoniac made by Quick-lime, a frothing, or effervescence as it is called, enſues, ſtronger and of longer continuance than that produced by the ſame ſpirit with any other natural Balſam: By this mark we may diſtinguiſh the genuine Copaiba from the thin Reſin of the Turpentine or Fir-tree, which is frequently mixed with, or vended for it (*f*). This Balſam is at preſent of very common uſe, or miſuſe, as a medicine.

BAL-

(*e*) *Tolu.*] Of the tree which produces this balſam we have no particular deſcription. Linnæus has given its generical characters, under the name of *Toluifera*; and in theſe it differs greatly from the Firs and Pines, to which it is commonly reſembled. The balſam is one of the moſt elegant and grateful of the ſubſtances of this claſs, and does not loſe much of its fragrance when by age it grows conſiſtent. It yields very little eſſential Oil in diſtillation, but impregnates the diſtilled water ſtrongly with its flavour. By diſſolving in this water, in a gentle warmth, a proper quantity of fine Sugar, we obtain a balſamic ſyrup greatly ſuperior to that made in a common manner with a decoction of the balſam. I have ſometimes obtained from this balſam a ſaline matter, ſimilar to the flowers of Benzoine.

(*f*) *Copaiba.*] It is obſervable alſo of this balſam, that on being diſtilled in a retort, it gives over towards the end of the operation, an Oil of a fine blue colour, preceded by a limpid, and a yellowiſh or browniſh one. Diſtilled with water, it yields a large quantity of a limpid eſſential Oil; from ſixteen ounces I have gained eight.

The Copaiba-tree is one of the large foreſt trees of Brazil and ſome other parts of America: Mr. Ray calls it *Arbor Balſamifera Braziliensis fructu monoſpermo*. The leaves are roundiſh or oval, the flowers pentapetalous, the fruit a pod containing a kernel like a filbert. The Wood is of a deep red colour, and great hardneſs; and hence is employed in ornamental mechanic works, and is ſaid to be uſed alſo in dying. The balſam is extracted by making deep inciſions in the trunk of the tree, in the middle of the ſummer heats; if this operation is performed too early,

no

IV.
BALSAM of PERU.

BALSAM OF PERU is obtained from certain trees of Peru and Mexico, differing ſomewhat from one another in appearance, and ſomewhat alſo in the quality of their juices. The Balſam-tree deſcribed by Piſo, under the name of *Caburciba*, has ſmall leaves like thoſe of the Myrtle, and a thick aſh-coloured bark, covered with a very thin red one: under this is lodged a yellowiſh Balſam, that impregnates the whole ſubſtance of the bark, which by age becomes more and more fragrant. Hernandes deſcribes the Mexican Balſam-tree, as having leaves like thoſe of the Almond, and a thick bark like Cork, from which the Balſam flows upon wounding the outer thin rind. Plukenet mentions a tree of the ſame kind in Virginia, by the name of *Arbor Virginiana, Piſaminis folio, Baccata, Benzoinum redolens.*

There are three ſorts of Balſam of Peru: (1.) A colourleſs or pale yellowiſh, called *white*, in appearance ſomewhat reſembling the Opobalſam, and like it of a ſtrong ſmell: This is the native juice collected and preſerved in the ſame ſtate wherein it iſſues from the tree. Among us, it is rarely or never met with, (2.) A *dry* Balſam, or the foregoing inſpiſſated by the ſun's heat, in calabaſhes or gourd-ſhells, in which it is ſometimes brought into Europe: This has ſomewhat of a reddiſh colour, and ſtill ſmells very agreeably. (3.) The *common* or *black* Peruvian Balſam of the ſhops. This ſort is artificially extracted from the bark, branches and leaves of the tree by cutting them in pieces, and boiling them in water: The Balſam is ſaid to ſeparate, and ariſe to the ſurface, from whence it is taken off (g). A portion of the gummy or other

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no juice exudes, in which caſe the wounds are for a time cloſed up. It is ſaid that twelve pounds of balſam iſſue from one tree in a few hours; but that after once bleeding, it never affords more.

(g) *Balſam ariſes to the ſurface.*] This is the common account of the preparation of the balſam of Peru, firſt publiſhed by Cluſius, and copied by moſt of the later writers. It is not however very conſiſtent with the gravity of this balſam; for the ſeveral ſpecimens I have examined, inſtead of ſwimming, were found to ſink both in pure water, and in moderately ſtrong vegetable decoctions and infuſions. In cold water, the drops fall to the bottom entire: In boiling hot water, a ſmall portion ſeparates, and forms a fine thin pellicle upon the ſurface;

BALSAM of PERU.

matter of the plant which the water extracts, is retained by the Balſam and falls to the bottom upon diſſolving it in Spirit of Wine. Pomet and others report, that this Balſam is counterfeited or ſophiſticated with mixtures of expreſſed Oils and other ſubſtances: But happily the Balſam of Peru will not in any degree mingle with thoſe Oils; in which reſpect it differs from almoſt all the other reſinous bodies.

This Balſam is of a thick conſiſtence, like honey; of a dark black colour in the maſs, but when ſpread thin of a clear reddiſh or yellowiſh brown, of an agreeable ſtrong ſmell, ſomewhat approaching to that of a mixture of Benzoine and Storax, and of a bitteriſh pungent taſte, eaſily inflammable, not in the leaſt miſcible with water, nor rendered turbid or white on being agitated with that fluid. It becomes ſoluble in water, like the other Balſams, by the mediation of yolk of eggs or of Sugar: When diſſolved by the latter, it ſoon ſeparates from the water, whilſt the former keeps it much longer ſuſpended.

In diſtillation with water, it yields a ſmall quantity of a fragrant eſſential Oil: Hoffman prepares alſo a grateful ſpirit, by drawing over Spirit of Roſes from a mixture of the Balſam with half its weight of Salt of Tartar, divided by moiſt ſand. Diſtilled in a retort with an open fire, it affords a Butter like that of Benzoine, and oftentimes a conſiderable quantity even of concrete ſaline flowers, ſimilar to thoſe procured from that Reſin: Different ſorts of the Balſam exhibit ſome differences in this operation, but I have never met with one that did not yield both the Butter and Flowers.

V. TURPENTINES.

Chian.

TURPENTINES are extracted from different kinds of trees in Europe. The true Terebinth-tree (*Terebinthus vulgaris C. B.*) is found in Spain and the ſouthern parts of France, as well as in the iſland Chio and the Indies. It is a middling ſized Evergreen-tree, with leaves like thoſe of the Bay, bearing purpliſh imperfect flowers, and on ſeparate pedicles, hard unctuous berries like thoſe of the Juniper buſh. It is extremely reſinous, and unleſs the Reſin is diſcharged, decays, pro-

TURPENTINE.

produces fungous excreſcences, ſwells, burſts and dies; the prevention of which conſiſts wholly in plentiful bleeding both in the trunk and the larger branches. The juice is the Chio or Cyprus Turpentine of the ſhops: This ſort, as we now and then meet with it (for among us it is very rare) is of quite a thick conſiſtence, of a greeniſh-white colour, clear and tranſparent, of ſcarcely any taſte, and but little ſmell.

Venice.

The Larch-tree (*Larix folio deciduo conifera J. B.*) plentiful in ſome places of France, particularly in Dauphiny, as alſo in Auſtria, Tyrol, Italy, Spain, &c. is no leſs reſinous than the Terebinth, and no leſs ſubject to ſwell and burſt unleſs its Reſin is evacuated. The young trees yield a thin limpid juice, greatly reſembling Balſam of Copaiba, called by the French *Bijon*; the older, a yellower and thicker one. What is called Venice Turpentine is no other than this juice, brought chiefly from Dauphiny, about the conſiſtence of a thick Syrup, or Honey, tranſparent, of a pale yellowiſh, a yellow, browniſh, or reddiſh-brown colour according to its age, of a bitteriſh taſte, and a ſtrong, not agreeable ſmell. What the Venice Turpentine originally was, is now unknown. It is ſuppoſed that Venice was formerly the mart for the Turpentine collected from the Terebinth-tree in the iſland Cyprus; and that the thinner juice was called Venetian, and ſuch as had grown thick Cyprian. At preſent we receive no Turpentine from Venice or from Cyprus.

Straſb

The Straſburgh Turpentine, *Terebinthina Argentoratenſis*, ſo called from the place of its production, is extracted from the Silver-fir, the *Abies conis ſurſum ſpectantibus ſive mas* of Caſpar Bauhine (*b*). The common Turpentine is prepared from different ſorts of the pine. This laſt is frequently ſophiſticated or counterfeited with mixtures of different reſinous ſubſtances,

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(*b*) *Turpentine from the Firs.*] Some of the exotic Firs afford Balſams or Reſins ſuperior to thoſe obtained from the European ones, as particularly that called Baſm-of-Gilead Fir, which is now naturalized to our own climate. A large quantity of an elegant reſinous juice may be collected from the cones of this tree: The leaves alſo emit, when rubbed, a fragrant ſmell, and yield with rectified ſpirit, an agreeable reſinous extract.

TURPENTINE.

ſtances, ſolid and liquid; It is quite thick, white, and untranſparent.

Oil of Turpentine.

All the Turpentines yield a conſiderable proportion of Oil. From ſixteen ounces of Venice Turpentine (the ſort principally employed for medicinal purpoſes) were obtained by diſtillation with water, four ounces and three drams of eſſential Oil. The ſame quantity diſtilled without addition, in the heat of a water-bath, gave but two ounces and an half; and from the reſiduum, treated with water, only an ounce could be obtained; ſo that by this method the yield of Oil is near an ounce leſs than when the Turpentine is diſtilled directly with water. The water remaining in the ſtill is found to have extracted little or nothing from the Turpentine: On the contrary, the Turpentine imbibes a part of the water, the reſiduum and the Oil amounting together to a full ounce more upon the pound than the quantity of the juice employed.

Common Reſin.

When Turpentine is diſtilled or boiled with water till it becomes ſolid, it appears yellowiſh; when the proceſs is further continued, of a reddiſh-brown colour: In the firſt ſtate, it is called boiled Turpentine, in the latter Colophony.

On diſtilling ſixteen ounces in a retort, with an open fire increaſed by degrees, we obtain firſt four ounces of a limpid colourleſs Oil, then two ounces and two drams of a yellowiſh one, four ounces and three drams of a thicker yellow Oil, and two ounces one dram of a dark browniſh-red empyreumatic Oil of the conſiſtence of Balſam, and commonly diſtinguiſhed by that name.

The eſſential Oil called ſpirit of Turpentine, is remarkably difficult of ſolution in Spirit of Wine, though Turpentine itſelf diſſolves eaſily. One part of the Oil may indeed be diſſolved in ſeven parts of rectified ſpirit, and the ſolution is in appearance perfect; but on ſtanding for a little while, the limpid liquor becomes milky, and by degrees greateſt part of the Oil ſeparates and falls to the bottom, a much larger proportion of the ſpirit being requiſite to keep it diſſolved.

Uſes of Turpentine.

Turpentine and the Reſin left upon diſtilling it, are employ-

Turpentine.

employed in various cements, lacquers, varniſhes, in fire-works, &c. As a medicine it is a hot, ſtimulating, detergent, diuretic, poſſeſſing at the ſame time in a notable degree, the healing and corroborating virtues of the other Balſams. The Oil is far more ſtimulating than the Turpentine itſelf; and hence in many caſes where ſuch a quality would be very injurious, the Reſin or Turpentine freed from the hot Oil is given with ſafety. Both Turpentine itſelf and its preparations are of frequent uſe alſo externally, in plaſters, digeſtive ointments, and vulnerary Balſams. The Oil is ſaid to be particularly ſerviceable in wounds of the nervous and tendinous parts; and a ſolution of it in Spirit of Wine, applied warm, to be one of the moſt effectual ſtyptics in profuſe hæmorrhages.

Tar.

IF the wood of the Turpentine-trees be expoſed to the fire, in a veſſel every where cloſed except an aperture at the bottom, as for example in a retort with the neck placed lowermoſt, the reſinous juice melts out by the heat and at the ſame time contracts an empyreumatic ſmell and taſte: In this ſtate it is Tar. Tar is prepared in different parts of Germany, Norway, Sweden, &c. from the Pine and the Fir-trees, and in ſome places from the Larch and the Terebinth. The wood is incloſed in a large oven, to the quantity of ten or more loads at a time: This ſtands within another oven called the mantle, the ſpace betwixt them receiving the fire: From the bottom of the inner oven runs a gutter, by which the Tar is conveyed off in proportion as it melts out from the wood.

Pitch.

Tar boiled down to dryneſs, is the common black Pitch: This part of the proceſs is commonly performed in a ſtill, in order to ſave an eſſential Oil which ariſes in the boiling, and which is called from the name of the tree which Tar is pincipally prepared from, *Oleum pini*, and *Oleum tædæ*. This oil is greatly valued by painters, varniſhers, &c. on account of its drying quality: it ſoon thickens of itſelf, almoſt to the conſiſtence of a Balſam. Along with the Oil there comes over a watery liquor, which the workmen injudiciouſly

Oleum pini

Acid Spirit.

TURPENTINE.

diciouſly through away: It is a good acid ſpirit, capable of being applied to ſundry uſeful purpoſes: I know a perſon in France who has ſaved by it ſeveral thouſand dollars.

Experiments on Pitch.

Pitch is not, as ſome have ſuppoſed, a pure and perfect Reſin: It has not only ſuffered a notable change from the heat employed in its preparation, but likewiſe participates of the other principles of the wood, of gummy and ſaline matter, and of a burnt earth. Hence its diſpoſition to ſeparate and precipitate when melted with Oils, Fats and Reſins, into plaſters and ointments: And hence it is gradually corroded by air and moiſture when employed as a cement or defence for wood or other ſubſtances, in ſhips, land-carriages, ciſterns, caſks, ſhingle coverings for houſes, &c. Ship-builders endeavour to improve their Tar and Pitch, ſo as to render them more durable by various additions (*i*).

Two ounces of dry Pitch, treated with rectified Spirit of Wine, gave but one ounce and half a ſcruple of reſinous extract: Half an ounce of an empyreumatic Oil ſeparated during the digeſtion, and there remained undiſſolved half an ounce of earthy matter, from which water would extract nothing. The ſame quantity of the ſame Pitch boiled at firſt in water, yielded two drams and half a ſcruple of gummy extract: From the remainder, nevertheleſs, were obtained ten drams of ſpirituous extract, that is, near two

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(*i*) *Additions for rendering Tar more durable.*] An anonymous correſpondent of the Swediſh academy obſerves, that the tarred or pitched boards and ſhingles, with which houſes in many places are covered, are ſoon damaged by heat and moiſture, the ſun's heat melting off the Tar, ſo that the wood remains bare. Some have endeavoured to prevent this, by laying on the Tar late in the year, that the winter's cold might fix it; an expedient of ſome uſe, but very far from being effectual; for however the Tar may be hardened by the winter, the return of ſummer-ſeaſon makes it ſoft again. Others have mixed ſmith's cinders with the Tar, which inſtead of mending the matter makes it worſe, and all ponderous ſubſtances do the ſame. He ſays he has never found any addition comparable to Coal-duſt [that of Charcoal he ſeems to mean,] which is to be ſtirred into Tar made hot, in ſuch quantity as to render it thick: The mixture is to be laid on with wooden trowels, in a hot day. Tar thus prepared, he ſays, is fixed; never runs, binds and hardens ſurprizingly from heat and moiſture, and ſhines better than Oil varniſh.

TURPENTINE.

two drams more than when ſpirit was applied at firſt, the indiſſoluble part amounting as before to half an ounce. The diſtilled water ſmelt and taſted almoſt like red herrings: The ſpirit had no remarkable impregnation. Eight ounces of pitch diſtilled in an open fire, yielded two ounces one dram and a half of an acid ſpirit, and two ounces five drams of a fetid Oil, three ounces of a ſhining black coal remaining in the retort.

The uſe of Pitch as a medicine, unleſs for external purpoſes, is not to be recommended. The Pitch ſcraped off from beer caſks was the Arcanum of a certain midwife againſt uterine hæmorrhages, and indeed ſeldom failed to reſtrain the flux, but commonly in a few days brought on unfavourable conſequences.

Lamp-black.

The ſoot which ariſes in the burning of Pitch, is the ſubſtance commonly ſold under the name of Lamp-black: In France, the Pitch is burnt for this purpoſe in a kind of furnace made of tiles, ſo diſpoſed as to prevent the eſcape of the ſmoke (*b*).

VI.
SOLID STORAX.

THE moſt fragrant of the ſolid Reſins, and indeed of all the known vegetable ſubſtances, is STORAX or Styrax, obtained from a tree of the ſame name, ſaid to grow moſt plentifully in Syria, Cilicia and Pamphylia. America likewiſe produces Storax-trees, but not that particular ſpecies which affords the officinal Reſin. The true Storax-tree has leaves like thoſe of the Quince, and hence is named by Caſpar

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(*b*) *Lamp-black.*] What is called Lamp-black (originally perhaps the ſoot collected from lamps) is obtained, in different parts of Germany, Sweden, *&c.* not from pure Reſin or Pitch, but from the dregs and pieces of bark of the tree ſeparated in their preparation. For making common Reſin, the impure juice collected from inciſions in Pines and fir-trees, is boiled down with a little water, and ſtrained whilſt hot through a ſack: On cooling, the Reſin congeals upon the ſurface of the water, and is then packed up in barrels; it is diſtinguiſhed according to its colour, into white, yellow and brown. The droſs left on ſtraining, is burnt for Lamp-black, in a low oven, from which the ſmoke is conveyed by a long paſſage into a ſquare chamber, having an aperture in the top, upon which a large ſack is faſtened: The ſoot concretes partly in the ſack, which is occaſionally removed, and partly in the chamber and canal, from which it is ſwept out.

Lamp-black is more oily or reſinous than the common wood ſoot: It gives out more to ſpirit and leſs to water by infuſion, and yields a larger quantity of Oil on diſtillation. Mixed with boiled Oil, and a little boiled Turpentine, it forms the black compoſition uſed as ink in printing.

SOLID STORAX. Caſpar Bauhine and Tournefort *Styrax folio mali cotonei:* Its flowers are white, in ſhape ſomewhat like a funnel, divided into ſeveral ſegments about the edges: The fruit is about the ſize of a Hazel-nut.

The fine Storax, called red Storax or Storax in the tear, is the pure native juice, flowing from inciſions made in the trunk of the tree. This is very rarely to be met with among us—The common Storax is ſuppoſed to be in part an artificial compoſition, mixed with a conſiderable portion of the genuine Reſin (*l*); Pomet goes ſo far as to ſay, that he knew the way of making it. This ſort was formerly brought to us incloſed in reeds or canes, whence its name *Styrax calamita*: At preſent we meet with it in large cakes or loaves, of a reddiſh brown colour, ſoftiſh and as it were unctuous to the touch, yet brittle and friable, intermixed with a notable quantity of ſaw-duſt, of an extremely pleaſant ſweet ſmell.

Out of an ounce of common Storax, rectified Spirit of Wine diſſolved ſix drams: From the reſiduum, water extracted half a dram of gummy matter: The reſt was almoſt mere ſaw-duſt. Another ounce of the ſame Storax treated with water at firſt, gave two drams of extract; after which it yielded with Spirit four drams of Reſin, the ſaw-duſt remaining as before.

Pure

(*l*) *Common Storax.*] Of the production of this concrete, we have no ſatisfactory account . . . That it is not an artificial compoſition, may be judged from hence; that notwithſtanding its large admixture of ſaw-duſt, it is more fragrant than the pure Storax in the tear, and its fragrance is exactly of the ſame kind. Some reſinous bodies indeed diſcover a greater degree both of ſmell and taſte, when diluted with other ſubſtances of themſelves inodorous and inſipid, than in their pure ſtate: But the pure Reſin extracted from common Storax by Spirit of Wine, is ſtill more fragrant than the Storax itſelf, and than the Reſin prepared by the ſame means from Storax in the tear.

It ſeems probable, that the pure Storax is the juice which concretes upon the tree, and which has loſt in the drying, its more ſubtile odoriferous parts; and that the common Storax is the juice received immediately in veſſels, and mixed with ſaw-duſt enough to thicken it, the ſhops requiring under the name of Storax a ſolid or conſiſtent maſs, and evaporation being found to diſſipate its fragrance. At leaſt I cannot conceive for what other purpoſe the woody matter could be added; for it is too eaſy diſtinguiſhable to have been intended as an impoſition.

The Storax-tree is ſaid to grow ſpontaneouſly, not only in the eaſtern countries, but in Italy; whether it yields any Reſin there we have no account. It ſcarcely bears the winters of our climate without ſhelter.

SOLID STORAX.

Pure ſpirit elevates in diſtillation very little of the ſmell of the Storax: The diſtilled water is notably impregnated with its fine flavour, but no ſeparable Oil is obtained. To determine this laſt point more fully, I diſtilled eight ounces of Storax with ſixteen ounces of water in a glaſs retort: No appearance of Oil could be perceived till the water was almoſt all drawn off, and the remaining Storax begun to grow dry and ſcorched: Then aroſe a fine ſubtile Oil, weighing two ſcruples, together with nine drams of an empyreumatic liquor: Preſently ſucceeded two drams and a ſcruple of thick butyraceous Oil, and afterwards two ounces one dram of an empyreumatic Oil, which had nothing of the ſmell of the Storax, along with five drams of an acid ſpirit: The reſiduum weighed two ounces and ſeven drams. The butyraceous Oil being waſhed with warm water, and the water ſet by in a cold place, a ſmall portion of ſaline matter ſeparated, ſimilar in appearance to the flowers of Benzoine.

Though rectified ſpirit diſtilled from Storax, brings over little or nothing of its ſmell; we may nevertheleſs obtain a ſpirit pretty ſtrongly impregnated both with the ſmell and taſte of the Storax, by previoſly mixing the Reſin with twice its weight of Salt of Tartar, and drawing over a rectified Spirit of Wine from this mixture. The ſtrongeſt and moſt fragrant principle, ſeparable from Storax, is the ſubtile, ſlightly empyreumatic Oil, which ariſes firſt in the diſtillation of it.

Storax is employed in medicine as a corroborant and reſolvent, both internally, and in plaſters and ointments: But its principal uſe is in perfumes of various kinds. For the nicer purpoſes, it ſhould be purified by diſſolving it in Spirit of Wine, and gently drawing off the ſpirit. Some boil the Storax in Wine, till it becomes ſoft enough to be preſſed from its impurities through a ſtrainer: This method is leſs eligible than the other, as a part of the Storax is retained among the ſaw-duſt. Mr. Charas obtained by expreſſion only three ounces of purified Reſin from

SOLID STORAX.

from eight ounces of Storax, whereas by Spirit of Wine, the yield is juſt double.

VII. LIQUID STORAX.

IN the ſhops, we meet with a fluid reſinous ſubſtance, called STYRAX LIQUIDA. This is ſaid by ſome to be extracted by expreſſion from the bark of the Storax-tree; by ſome from the leaves, or the leaves and bark together (*m*), and by others, to be a compoſition of Turpentine, Oil, Wine, and a little ſolid Storax. This laſt account is the moſt probable. There is a perſon in our neighbourhood [Berlin] who prepares ſome hundred weights every year, and is ſaid to employ chiefly common Reſin.

Four drams of liquid Storax yielded, with rectified Spirit of Wine, three drams and one ſcruple of reſinous extract: From the remaining two ſcruples, Water

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(*m*) *Liquid Storax.*] The genuine liquid Storax is obtained not from the tree which yields the ſolid Storax, but from one of a different genus, though uſually called by the ſame name. That which yields the ſolid is diſtinguiſhed by the epithet *Quinceleaved*, and that which yields the liquid by that of *Maple-leaved* Storax.

The Maple-leaved Storax tree is a native of Virginia, Mexico, and ſome other parts of America, and is eaſily naturalized to our own climate. A reſinous juice, approaching in fragrance to Storax, exudes upon the ſurface of the leaves, and may be extracted more perfectly by Spirit of Wine: The proceſs by which the juice is procured abroad has not been tried with the trees raiſed here.

Liquid Storax and liquid Amber are ſaid to be both obtained from this one tree, the firſt by boiling the bark or branches in water, the latter by making inciſions in the trunk——Mr. Petiver, gives an account in the Philoſophical Tranſactions, of the preparation of liquid Storax, as practiſed in the iſland Cobros in the Red-ſea, from a tree (which probably is no other than this) called by the Turks and Perſians Roſa-Mallos. The bark is annually cleared off, and boiled in ſea-water to the conſiſtence of Bird-line. The reſinous matter, which floats upon the ſurface, and contains a conſiderable portion of the ſubſtance of the bark, is taken off, liquefied again in boiling Water, and paſſed through a ſtrainer. The purer part which paſſes through, and the more impure which remains on the ſtrainer, are both ſent to Mocca, from whence they are ſometimes, but very rarely, brought to us. The firſt is of the conſiſtence of Honey, tenacious like Turpentine, of a browniſh colour, an acrid aromatic unctuous taſte, and a ſmell approaching to that of ſolid Storax, but ſo ſtrong as to be diſagreeable. The impure ſort is full of woody matter, and much weaker in ſmell.

The liquid Amber, or juice which iſſues from inciſions in the trunk, is at firſt of the conſiſtence of thin Turpentine, but by long keeping grows hard and brittle. It is of a yellow colour inclining to red, of a hot aromatic taſte, and a fragrant ſmell, not unlike that of Storax heightened with a little Ambergris. It was formerly much uſed as a perfume, but is at preſent ſcarcely known in the ſhops.

Liquid Storax.

Water took up only a few grains: The diſtilled ſpirit ſmelt a little of the Reſin. In diſtillation with Water, an eſſential Oil aroſe, ſimilar in flavour to Oil of Turpentine or the *Oleum pini*. By diſtillation in a ſtronger fire, inſtead of a clear empyreumatic Oil, what came over was almoſt mere pitch. Theſe experiments are a ſufficient proof that the common liquid Storax is an artificial compound.

Thymiama.

THE CORTEX THYMIAMATIS, called by the ancients *Thus Judæorum* from its uſe among the Jews in fumigations, is ſuppoſed to be the bark of the Storax-tree, remaining after the genuine Liquid-ſtorax has been extracted by expreſſion or boiling. Greateſt part, however, of what we now and then meet with under this name in the ſhops, is no other than the bark of European trees, artificially impregnated with reſinous matter. We may be aſſured that this is the caſe, where the Thymiama, like that examined by Hoffmann, abounds with Reſin (*b*).

VIII. Benzoine.

BENZOINE, *Benzoinum*, *Benzoe*, *Belſoe*, *Aſa dulcis*, comes the neareſt in fragrancy to Storax. The tree which produces Benzoine is a native of the Eaſt Indies, particularly of the iſlands Siam and Sumatra. It has ſoft thin leaves, nearly like thoſe of the Citron-tree, and bears a round fruit about the ſize of a hazel-nut: It is never permitted to exceed the ſixth year, as being after this period unfit for yielding Reſin; the inhabitants then cut it down and ſupply it by a young one raiſed commonly from the fruit. One tree does not yield above three pounds of Benzoine (*i*).

(*b*) *Hoffmann's experiments on the Cortex thymiamatis.*] This ſubſtance, common he ſays in the German ſhops (but ſcarcely ever to be ſeen in ours) has the appearance of a mixture of bark and leaves bruiſed and preſſed; and approaches in ſmell to liquid Storax. Rectified Spirit of Wine extracted from it a black tincture, ſimilar to a ſpirituous ſolution of Balſam of Peru. The liquor poured into Water became immediately milky: The ſpirit, drawn off by diſtillation, was of a very fragrant ſmell, ſo diffuſive that a ſingle dram impregnated with its fragrance ſome quarts of Water: The Reſin, which remained, had alſo a very pleaſant fragrance; and amounted to at leaſt two ounces from a pound of the bark.

(*i*) *Benzoine.*] The Benzoine-tree (or at leaſt one which is ſuppoſed to be the ſame with that which affords Benzoine in the Eaſt Indies) is

BENZOINE.

The juice exudes, from inciſions, in form of a thick white balſam: If collected as ſoon as it has grown ſomewhat ſolid, it proves internally white like almonds, and hence is called *Benzoe amygdaloides*: If ſuffered to lye long expoſed to the ſun and air, it changes more and more to a browniſh, and at laſt to a quite reddiſh brown colour. The dealers in this commodity never ſell us the fine white Benzoine by itſelf: but mix it with the inferior and fouler kinds, that one may carry off the other: Hence, in the very beſt Benzoine of the ſhops, we meet with pieces of various colours, white, yellowiſh white, yellow, browniſh yellow, brown, reddiſh brown, and grey, all united into one lump. The dark coloured Benzoine however, if it is free from earth and woody impurities, and from admixtures of any other Reſin, does not appear to be inferior in goodneſs to the white.

This Reſin is moderately hard and brittle; and yields, on being rubbed or warmed, an extremely agreeable ſweet ſmell. It totally diſſolves in Spirit of Wine into a blood red liquor, leaving only the impurities, which amount commonly to no more than about a ſcruple, upon an ounce. To Water, it gives out a portion, not of gummy or mucilaginous, but of ſaline matter, of a peculiar kind, volatile and ſublimable in the fire, and which indeed is moſt effectually ſeparated by dry ſublimation, and hence called *flowers* of Benzoine. Such a ſubſtance is ſuppoſed to be obtainable from Benzoine alone: I have diſcovered however, a like ingredient in ſolid Storax and in Balſam of Peru: and from the mineral kingdom alſo we may bring Amber in compariſon with it.

Flowers of Benzoine.

Some

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plentiful alſo in Virginia and Carolina, and has been thence brought into England, where it grows with vigour in the open ground. The bark and the leaves ſmell like Benzoine, and yield with rectified Spirit a Reſin of the ſame ſmell; but no Reſin has been obſerved to iſſue from it naturally in this climate; nor, ſo far as we can learn, has any Benzoine been collected from it in America; though Commeline calls it *Arbor Virginiana, citreæ vel limonii folio, Benzoinum fundens*, the Virginian tree, with leaves like thoſe of the Citron or Lemon-tree, *yielding* Benzoine. In its flowers and fructification it agrees with the bay, and hence is ranked by Linnæus as a tree of that genus, under the name of *Laurus foliis enerviis ovatis utrinque acutis integris annuis*, the bay with oval undivided leaves, pointed at both ends, not ribbed, falling off in the winter.

Benzoine.

Some prepare the flowers from Benzoine by itſelf, reduced into groſs powder; others mix it, in fine powder, with an equal quantity of waſhed ſand. An earthen pot or jar is filled with the matter to one half or one fourth its height, then covered with a conical paper cap, and placed in ſand: By a gentle heat, the flowers ariſe into the cap, which, as ſoon as any conſiderable quantity is judged to be collected, is removed, and ſupplied by another, and the proceſs continued till nothing more will ſublime: The remaining Benzoine, which appears of a blackiſh brown colour, may ſtill be uſed, if no ſand has been mixed, in compoſitions for yielding an odoriferous ſmoke, and for other like purpoſes. This method is not a little troubleſome, the quantity of flowers obtained by it ſmall, and the flowers themſelves commonly tinged of a yellowiſh or even a brown colour from ſome of the Oil of the Benzoine ariſing with them; for as the ſand grows continually hotter and hotter, it is ſcarce poſſible to prevent the heat increaſing ſo far as to elevate a portion of the Oil.

The beſt way is, to moiſten the Benzoine, groſsly powdered, with Spirit of Wine; and then proceed to diſtillation, with a very gradual ſand heat, in a wide necked glaſs retort. The flowers ariſe immediately after the ſpirit, partly in a concrete ſaline form, and partly in that of a white butter: The receiver being now changed, and the fire ſlowly increaſed, a ſmall portion of brown coloured flowers ſublimes, followed firſt by a ſubtile Oil, afterwards by a browniſh Oil, and at laſt by a black, thick, empyreumatic one, together with an acid ſpirit. If the flowers and butter be diſſolved in diſtilled Water over a gentle fire, the ſolution paſſed through a filter and ſet in the cold; the ſaline matter ſhoots into cryſtalline concretions, of a fine ſilver whiteneſs; this Salt, like Tartar, being difficult of ſolution, and when diſſolved in hot Water, ſeparating again as the liquor cools: The diſſolution and filtration ſhould be performed as expeditiouſly, and the veſſel kept as much covered, as poſſible, to prevent any conſidera-

BENZOINE. ble diſſipation of the volatile matter. The Salt ſtill retains, even after this purification, a portion of Oil; as appears from its penetrating ſmell, and from its burning in the fire. The Spirit of Wine, which ariſes at firſt in the diſtillation, is impregnated with a little of the Salt. The Oil which follows the flowers, rediſtilled from earthy powders, or with Water, may be uſed as an eſſential Oil of Benzoine, for it has little or nothing of an empyreumatic taint. From ſixteen ounces of Benzoine are obtained two ounces of rough flowers, nine ounces of Oil, and ſeven ſcruples of an acid ſpirit: The reſiduum weighs two ounces and a half.

Benzoine and its flowers are employed medicinally for reſolving and attenuating viſcid juices, particularly in diſorders of the breaſt: But the principal uſe of this fragrant Reſin is in perfumes, and as a coſmetic, for ſoftening and ſmoothing the ſkin. For this laſt purpoſe, the Benzoine is diſſolved in Spirit of Wine, with the addition ſometimes of Storax: The ſolution, mixed with Water, forms a white liquor called *Virgins-milk*; which on ſtanding, ſlowly depoſites a fine white magiſtery. Some add, to the tincture of Benzoine, a tincture or ſolution of litharge in Vinegar, and thus obtain a *Compound* virgins-milk and magiſtery, leſs innocent than thoſe from Benzoine alone——A ſmall quantity of the Oil of Benzoine heightens the ſmell of perfumes, and corrects rancid unguents and balſams.

Virgins milk.

TACAMAHACA.

TACAMAHACA is a fragrant Reſin collected in America. The tree which produces it is called by John Bauhine *Tacamahaca populo ſimilis, fructu colore pæoniæ*, Tacamahaca tree reſembling the poplar, bearing a fruit whoſe colour is like that of peony: The wood is named by the Engliſh, from the uſe to which it is principally applied, Saddle-wood (*k*).

(*k*) *Tacamahaca tree.*] This tree is a native of the more temperate parts of America, but bears the winters of our own climate, and yields, in the young buds or rudiments of the leaves which come forth early in the ſpring, a very fragrant balſam or Reſin, ſimilar in ſmell to the Tacamahaca brought from abroad. In its balſamic buds, as in its general appearance, it has a great reſemblance to the poplar.

TACAMAHACA. The Reſin which exudes ſpontaneouſly from the tree, is greatly ſuperior to that which iſſues from wounds. The firſt is collected in gourd-ſhells, and proves of a clear ſemitranſparent yellow colour: This is rarely to be met with. The ordinary Tacamahaca conſiſts of tears of various colours, reddiſh, yellowiſh, grey, brown, blackiſh, clear and opake, pure and impure, joined together into one maſs, of a ſolid conſiſtence, partly reſembling Benzoine, intermixed with leaves and other vegetable matters.

This Reſin, when in perfection, has an aromatic taſte, and a very pleaſant ſmell, approaching to that of Lavender or Muſk. It diſſolves totally, if pure, in rectified Spirit of Wine: Out of an ounce, there remained only about eighteen grains undiſſolved; and theſe were wholly an heterogeneous matter, on which Water had no action. Water, applied at firſt, extracted only about ſeventeen grains from an ounce. In diſtillation, neither Water nor Spirit bring over any thing conſiderable; this Reſin being very tenacious of its flavour. It is uſed chiefly in plaſters and fumigations.

LADANUM. LADANUM or Labdanum is the produce of a ſmall ſhrub; which is a ſpecies of *Ciſtus* or Rockroſe growing plentifully in the warmer climates, particularly in Greece, in the iſland Candy, as alſo in Portugal and Spain, called by Tournefort *Ciſtus ladanifera cretica flore purpureo.* The ſhrub is only two or three feet in height: Its leaves are ſomewhat like thoſe of Sage; the flowers pentapetalous, of a purple colour variegated with a roſe red.

The Reſin exudes, not from the ſtem, but upon the ſurface of the leaves. It was formerly collected only from the beards of goats who browſed upon the plant, and in this manner a little is ſtill procured: Hence the hairs intermixed in ſome of the maſſes of Ladanum, called *Ladanum à barbis.* The greateſt quantities are now collected in Candy, by drawing over the plant, backwards and forwards, in the calmeſt and hotteſt weather, a kind of rake with leathern thongs inſtead of teeth: The tenacious juice

LADANUM. adheres to the thongs, and is afterwards ſcraped off with knives. It is ſaid that one perſon can thus collect three pounds and two ounces in a day. As the plant grows chiefly upon dry ſandy hills near the ſea-ſhores, where there is conſtantly a little wind, the Reſin can never be procured free from an admixture of duſt: The collectors alſo purpoſely mix with it a certain fine black ſand, found in the neighbourhood, not diſtinguiſhable by the eye from the Ladanum itſelf. In Spain, a more expeditious method is purſued: The leaves of the ſhrub are boiled in Water, and the Reſin, which ariſes to the ſurface, ſcummed off. The Ladanum thus obtained is one of the worſt kinds; the more ſubtile and volatile parts of the juice being diſſipated in the boiling.

Good Ladanum looks like a maſs for making pills, of a blackiſh grey or an unſightly black colour: It is untranſparent; eaſy to break, free from any viſible impurities, of a bitteriſh and aſtringent taſte: It readily ſoftens over the fire, and when laid on burning coals, yields an agreeable ſmell. The admixture of ſand may be diſcovered by its grittineſs betwixt the teeth when long chewed, but more perfectly by ſolution.

From ſixteen ounces of Ladanum I obtained, by rectified Spirit of Wine, eleven ounces two drams and two ſcruples of Reſin: The remainder yielded with Water, an ounce of gummy extract; three ounces five drams and one ſcruple of indiſſoluble matter being left. On treating the ſame quantity of Ladanum firſt with Water, I had two ounces four ſcruples of a gummy or rather gummy-reſinous extract: The Reſiduum, treated with ſpirit, gave ten ounces two drams two ſcruples of pure Reſin; three ounces and a half of indiſſoluble impurities remaining. In diſtillation with Water, a very ſmall portion of an eſſential Oil ariſes: Spirit of Wine likewiſe brings over ſo much oily matter, as to ſmell and taſte ſtrongly of the Ladanum, and grow milky upon the admixture of Water.

This Reſin is employed in plaſters and ointments, LADANUM.

as a corroborant and diſcutient, but principally as an ingredient in odoriferous compoſitions, and fumigations. It ſeems to be one of thoſe drugs which, in all the intentions it has been uſed for, may be ſpared without much inconvenience.

ELEMI.

ELEMI is a Reſin of Aſiatic origin: The plant, which produces it, is not as yet known with certainty. There is alſo an inferior kind, brought from America which is the only one now to be met with in the ſhops: The parent of this ſort is called by Ray *Arbor Brazilienſis gummi elemi ſimile fundens, &c.* a Brazilian-tree, yielding a gum like Elemi, with winged leaves, verticillate flowers, and a fruit about the ſize and ſhape of an olive.

The true Elemi comes over in large oblong maſſes or round loaves, generally wrapt up in leaves of the Indian reed. It is of a yellowiſh or rather greeniſh white colour; ſemitranſparent; of a ſoft conſiſtence, betwixt that of Wax and Turpentine, or dry on the outſide and ſoftiſh within: By age, it grows hard and brittle throughout. It has a moderately ſtrong, not unpleaſant ſmell; reſembling that of a mixture of Fennel, Daucus, and Smallage-ſeeds. It is commonly full of impurities, which are obvious enough to the eye.

Out of ſixteen ounces of the purer maſſes, rectified Spirit of Wine diſſolves fifteen: Of the remaining ounce, Water takes up only one ſcruple. Water applied at firſt diſſolves, out of the ſame quantity two drams and two ſcruples: From the remainder, ſpirit extracts fourteen ounces of Reſin. Both Water and ſpirit become ſtrongly impregnated with its flavour by diſtillation: Along with the Water ariſes a very elegant and grateful eſſential Oil, amounting to an ounce from ſixteen ounces of the Elemi.

Neither the Oil, the Spirit, or the Water, have as yet been received in Medicine; though I am convinced they are applicable to valuable purpoſes; provided we are on our guard, in the choice of the Elemi, againſt the too common ſophiſtications or counterfeits made with boiled Turpentine and other

ELEMI. matters. This Reſin has hitherto been employed only in external applications; in nervine, vulnerary, and digeſtive plaſters and balſams. In making theſe kinds of compoſitions, we muſt be careful to avoid too great a degree of heat in mixing the ingredients; leſt the eſſential Oil, the moſt uſeful part of the Elemi, be loſt.

XII. ANIME. ANIME, *Amine*, or *Cancamum*, is obtained from an American tree, of which we have no very certain account, ſaid to grow chiefly in New Spain and Brazil. The Reſin is brought over in yellowiſh white, tranſparent, ſomewhat unctuous tears, and partly in larger maſſes, brittle, of a light pleaſant taſte, eaſily melting in the fire, and burning with an agreeable ſmell.

It diſſolves totally in rectified Spirit of Wine, the impurities only being left, which commonly amount to no more than about five grains on an ounce. Water extracts about half a dram from an ounce: The decoction inſpiſſated leave an unctuous maſs, which makes the fingers manifeſtly oily. The ſpirit drawn off by diſtillation, ſmells and taſtes conſiderably of the Anime: The diſtilled water diſcovers on its ſurface ſome ſmall portion of an eſſential Oil.

This Reſin is uſed chiefly in nervine, cephalic and reſolvent plaſters. It can ſcarcely operate any otherwiſe than as a mere reſinous ſubſtance, and may not improperly be ſupplied by cheaper Reſins. Greateſt part of what we meet with under this name in the ſhops, is indeed no other than common Reſin, flavoured with a little of the eſſential Oil of a certain umbelliferous plant.

XIII. MASTICH. MASTICH is the produce of a ſmall tree, called Lentiſk or *Lentiſcus*. The bark of the tree is unequal, rugged, and of a grey colour, the branches tough and flexible, the leaves winged and ſet in pairs, and the flowers, which come forth in cluſters, apetalous or imperfect. The fruit, at firſt like a red berry, is when ripe a ſhining black nut.

The wood of this tree was formerly of conſiderable eſteem in medicine, and has of late years alſo been

MASTICH.

celebrated for a variety of virtues, particularly that of ſtrengthening the nerves, by Joh. Bapt. de Wengh and John de Muralto, in the *Ephemerides naturæ curioſorum.* It ſeems however to be better fitted for the uſe to which the Turks and others apply it, the making of lances and tooth-picks. Such at leaſt as we meet with in the ſhops is entirely inert. Good Maſtich-wood is ſaid to be hard and ponderous, externally grey, internally white, and of an aſtringent taſte: The officinal ſort is whitiſh on the outſide, reddiſh within, and oftentimes worm eaten. Pomet relates, that the Miſletoe of the Hazel-tree is frequently ſold in France for Maſtich-wood: This report is the more extraordinary, as the Miſletoe is vaſtly ſlenderer than Maſtich, and as a ſpecies of the Maſtich-tree itſelf grows naturally in that kingdom.

The common Maſtich-tree, *Lentiſcus vulgaris,* is found in France, Italy, Portugal and Spain; but this ſpecies yields little or no Reſin. That which affords Maſtich is the produce of the iſland Chio, and diſtinguiſhed in the catalogue of the Amſterdam garden by the title of *Lentiſcus vera ex inſula Chio cortice & foliis fuſcis.* About the beginning of Auguſt, the inhabitants make inciſions with large knives in the bark of the trunk, and in a few days after the juice begins to exude. About the end of September, they make freſh inciſions in the parts before untouched, and thus collect a little more. When the tears have grown dry and hard, they are cleanſed from ſand, *&c.* by ſifting, an operation very troubleſome to the workmen, as the fine duſt of the Maſtich ſticks about the eyes, ſo as ſcarcely to be got off with Oil.

Two ſorts of Maſtich are diſtinguiſhed in trade, choice Maſtich, or Maſtich in grains, and a more impure dark-coloured kind, called Maſtich in ſorts, or ſimply Maſtich. For plaſters and other like purpoſes, the purer pieces of this laſt kind are commonly made uſe of; but ſome care is requiſite in the choice, common Reſin or Frankincenſe being often mixed with it. Good Maſtich is of a pale yellowiſh colour, in roundiſh or ſomewhat oblong tears, clear and tranſ-

MASTICH.

ſparent, dry without any unctuoſity. It has a pleaſant light ſmell, and in burning yields a ſmoke not diſagreeable. In chewing, it impreſſes a ſlight not ungrateful taſte, and becomes ſoft and tough like Wax: By this mark, ſophiſtications of it with Sandarach are readily diſtinguiſhed, that Reſin proving friable betwixt the teeth.

Maſtich diſſolves almoſt totally in rectified Spirit of Wine: It is pretty ſingular, that during the digeſtion a portion ſeparates, indiſſoluble in the ſpirit, though in appearance reſinous, amounting to about two ſcruples upon an ounce of the pure grains. Water far from diſſolving Maſtich, as ſome pretend it does, has no action either on Maſtich itſelf or on this reſiduum. In diſtillation, nothing ariſes with ſpirit, and nothing conſiderable with water. Hoffman, however, has diſcovered a method of impregnating rectified ſpirit by diſtillation, both with the ſmell and taſte of the Maſtich: He mixes the Reſin with an equal quantity of Salt of Tartar, then adds the ſpirit, and proceeds to diſtillation in a glaſs body with a very gentle fire.

Maſtich is made an ingredient in various kinds of varniſhes, and employed medicinally as a corroborant and reſtringent. It is chewed for ſweetening the breath, preſerving the teeth, and ſtrengthening the gums; and from this uſe as a maſticatory is ſuppoſed to have received its name. Large quantities are ſent annually from Chio, by way of tribute, to the Grand Signior; greateſt part of which is conſumed for thoſe purpoſes at court. This tribute of Maſtich is ſaid to amount to the value of four or five thouſand ducats: According to Tournefort's account, it muſt conſiderably exceed that ſum.

XIV. GUAIACUM.

GUM GUAIACUM, ſo called, is a Reſin exuding from the Guaiacum-tree, of which hereafter. It is of a brown colour, partly reddiſh, and often greeniſh, brittle, of a gloſſy ſurface when broke, of a pungent taſte, and when rubbed or heated, of a not diſagreeable ſmell: Its ſmoke in burning, has ſomewhat the ſmell of that of wood. Such ſhould be

GUAIACUM.

choſen as has pieces of the bark adhering, and eaſily parts from them by a few quick blows. The maſſes which have no bark, eſpecially the large ones, are often ſophiſticated: I received for Gum guaiacum, a whole box of an artificial compoſition of Colophony and Balſam of Sulphur: This abuſe was readily diſtinguiſhable by the ſmell of the compound when laid upon burning coals, and even by its appearance upon breaking.

Out of an ounce of Gum guaiacum, rectified Spirit of Wine diſſolves ſix drams and two ſcruples: Of the remainder, water takes up only ten grains, all the reſt being an indiſſoluble earth. Water applied at firſt, extracts four ſcruples out of an ounce: Of the reſiduum, ſpirit diſſolves four drams and two ſcruples. In diſtillation, it gives over a little both to water and to ſpirit, ſo little as to be altogether inconſiderable.

Its virtues are the ſame with thoſe of the wood. It is uſed pretty frequently in England, very rarely in Germany, the pure Reſin artificially extracted from the wood by means of Spirit of Wine, advantageouſly and elegantly ſupplying its place (l).

CLASS

(l) *Additional articles.*] COPAL. This Reſin is brought in irregular lumps from New Spain, where it is ſaid to be obtained from different ſorts of large trees, of which eight are deſcribed by Hernandez. Some pieces are whitiſh, ſemitranſparent, friable, not unlike the finer kinds of common Reſin groſsly powdered and forced together into a maſs. Others are more tranſparent and leſs friable, and of a yellowiſh or brown colour. It has a more agreeable ſmell than Frankincenſe, to which ſome have reſembled it, and does not melt ſo thin or burn away ſo faſt upon a red-hot iron. It does not ſoften in the mouth, on being chewed, like Anime with which it has been confounded by others. From theſe and other reſinous bodies it differs more remarkably, in its being exceeding difficultly diſſoluble in rectified Spirit of Wine.

Solutions of Copal have been greatly eſteemed as varniſhes, and the method of making the ſolution kept a ſecret in particular hands: Juncker informs us, that it readily ſucceeds, if Spirit of Sal ammoniac, mixed with a due proportion of Oil of Spike or Oil of Turpentine, is uſed for the menſtruum.

DRAGONS BLOOD.

DRagons Blood, *Sanguis draconis*, is a Reſin of a red colour, brought from the Eaſt-Indies. There are two ſorts of it; one in ſmall oval drops or tears, of a fine deep red, which is heightened into crimſon on

grinding

CLASS III.

GUMMY-RESINS.

GUMMY-RESINS. THOUGH ſome of the reſinous juices of the foregoing claſs contain a portion of gummy matter, they are not on that account to be

grinding them into powder; the other is in larger maſſes, apparently compoſed of tears: Of theſe, ſome are of a pale dull red, others of a deep one not at all inferior to the drop ſort.

The drops and the lumps are ſuppoſed to be the produce of two different trees. The lump ſort is ſaid to exude from the trunks of certain palms growing in the Madeira and Canary iſlands; the drop to be artificially extracted from the fruit of a tree. According to Kæmpfer, the fruit is laid upon a kind of hurdle, over a large veſſel half full of water: The whole being lightly covered, the water is made to boil, when the fruit being ſoftened by the ſteam, a red juice, which was not diſcoverable in it before, appears upon the ſurface: This is ſcraped off upon flag leaves, and expoſed to the air to dry. The ſame author informs us that ſome of the preparers of this commodity boil the fruit in water, till all the colouring particles are extracted or melted out; after which, the aqueous fluid is evaporated till the remainder begins to thicken, when it is further exſiccated upon flag leaves as before.

This drug has been ſometimes counterfeited with artificial compoſitions, coloured with the true Dragons Blood or Brazilwood: Theſe are diſtinguiſhed by their either diſſolving in water like Gums, or crackling, and not burning in the fire.

The genuine Dragons Blood is not acted upon by water, or at moſt communicates to it only a ſlight yellowiſh tinge: Laid on a red-hot Iron, it readily melts, catches flame, and emits an acid fume approaching to that of Benzoine. It diſſolves, but not perfectly, in rectified Spirit of Wine, and tinges a large quantity of the menſtruum of an elegant blood-red colour: It diſſolves readily in Oils, and tinges them of a pretty deep red, but ſomewhat leſs beautiful than the colour of the ſpirituous tincture, and conſiderably leſs ſo than that which Anchuſa imparts to Oil.

The ſpirituous tincture ſtains cold Marble of a bright fleſh colour; to warm Marble, it gives a deeper red in proportion to the degree of heat. Mr. du Fay obſerves, that by this one ingredient, with the addition of a little Pitch for the darker colours, all the various ſhades of red may be obtained from the lighteſt to the deepeſt; that it does not ſink near ſo far into cold as into hot Marble, and that the not ſinking is rather an advantage than an imperfection, as the colours which ſink muſt alſo ſpread, ſo as to render the drawing of fine deſigns impracticable; that the beſt way of obtaining beautiful reds from Dragons Blood is, to put the powdered Reſin into Spirit of Wine over the fire, and apply on the Marble with a pencil, the finer part of the ſolution which riſes up about the ſides of the veſſel, adding freſh ſpirit in proportion to the evaporation, till the Dragons Blood yields no more tincture.

This Reſin in ſubſtance, has no ſmell or taſte: When diſſolved, it diſcovers a ſlight degree of pungency.

ranked among Gummy-reſins. By Gummy-reſins GUMMY-RESINS. are underſtood thoſe only in which the quantity of Gum is ſo large, as to render the Reſin ſoluble along with it in water by the aſſiſtance of trituration, into a ſeemingly uniform but untranſparent liquor. Theſe ſolutions are only temporary: Upon ſtanding, greateſt part of the Reſin ſubſides again, the liquor becoming clear, and retaining no more than it would have taken up by infuſion or digeſtion. The ſolutions of the common Gummy-reſins obtained by triture, appear of a milky whiteneſs, excepting that of the high-coloured Gummy-reſin Gamboge, which communicates in ſome degree its high colour to the liquor.

GAMBOGE is brought from the Eaſt-Indies, I. GAMBOGE. in large cakes and rolls, ſolid and brittle, of a ſmooth ſurface, perfectly opake, free from any viſible impurities, of a deep reddiſh-yellow colour, equal and uniform throughout its whole ſubſtance. It ſtains the moiſt hands yellow, and makes a beautiful yellow Pigment for the painter (*m*).

This Gummy-reſin has received a variety of names: From the province which affords the largeſt quantities, it is called *Gambogia*, *Cambodia*, *Cambugium*; from the virtues aſcribed to it againſt the gout, *Gummi ad podagram*, *Gummi gutta*; by a corruption of theſe names, *Gummi ghitta*, *Gummi gotta*, *Gutta gamba*, *Gamandra*, *Gemou*, *Cattagemu*, *Catagauma*, &c. from its Gold colour, *Chryſopus*; from its purgative quality, *Succus laxativus*, *Succus indicus purgans*, *Scammonium orientale*, &c. It is ſuppoſed by ſome to be the produce of certain trees, deſcribed and figured in the *Hortus Malabaricus* by the name of *Coddampulli*; by others with greater probability, to be obtained from a ſhrubby plant, of the *Eſula* or *Tithymalus* kind: The qualities of Gamboge itſelf ſhew it to be more allied to the juices of theſe kinds of plants, than to thoſe of trees. Thus much is certain, that it is

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(*m*) *Gamboge—yellow Pigment.*] This Gummy reſin gives alſo a beautiful and durable Citron-yellow ſtain to Marble, whether rubbed in ſubſtance on the hot ſtone, or applied like Dragons Blood in the form of a ſpirituous tincture. When applied on cold Marble, the ſtone is afterwards to be heated, to make the colour penetrate.

GAMBOGE.

wholly a natural juice, not as ſome have pretended; Scammony or other like ſubſtances, coloured with Rhubarb, Turmeric, or Celandine.

Gamboge when firſt chewed, diſcovers little or no taſte, but ſoon after impreſſes a pungent acrimony and heat; and occaſions a dryneſs in the mouth. It eaſily melts over the fire, and takes flame from a candle: It burns, not as ſome report, with a blue, but with a white flame, and leaves not a black, but a grey aſh. Its reſinous and gummy matter are ſo intimately blended together, that both water and ſpirit, applied ſeparately, diſſolve greateſt part of both: Water acuated with fixed alcaline Salts in moderate proportion diſſolves nearly the whole. Out of ſixteen ounces, rectified Spirit of Wine takes up fourteen; and water out of the ſame quantity, takes up thirteen ounces. The two ounces left by ſpirit, give out one to water; and the three ounces left by water, give out two to ſpirit, the indiſſoluble matter amounting in both caſes to one ounce. This concrete appears therefore to contain more Reſin than Gum.

Gamboge is a ſtrong purgative, and oftentimes proves alſo emetic: It is uſed chiefly as an ingredient in cathartic powders and pills for hydropic caſes, in doſes of a few grains. The tincture or ſolution in Spirit of Wine purges more violently than the Gamboge in ſubſtance, eſpecially if inſpiſſated to the conſiſtence of an extract: The watery extract is conſiderably milder; and that made by water impregnated with fixt Alcali ſtill more ſo. An extract made with alcalized water from the matter left undiſſolved by Spirit of Wine, has little or no purgative virtue, but operates powerfully by urine. The Orientals are ſaid to prepare an uſeful extract with ſtrong Vinegar.

Sundry additions have been made uſe of for correcting or abating the violence of this medicine, as mineral Acids, Alcalies, eſſential Oils, Stomachics, Spices, neutral Salts, *&c.* But it ſeems more prudent to refrain from theſe kinds of draſtic medicines altogether, than to endeavour to mitigate them by correctors. Mr. Boulduc has given in the French Memoirs, GAMBOGE.

Memoirs, a pretty ſingular correction of Gamboge: He directs the powdered Gummy-reſin to be tied in a linen-cloth, incloſed in a loaf of bread hot from the oven, and kept warm for twenty-four hours, then powdered again, incloſed in a freſh loaf, and this proceſs to be repeated four or five times: By this means, he ſays, the Gamboge loſes its draſtic quality, and becomes a ſafe purgative: The crumb of the loaf in which it was firſt digeſted, is found to be ſtrongly impregnated both with the purgative and emetic virtue of the Gamboge. The activity of the Gamboge is doubtleſs by this treatment conſiderably abated; but the ſame end may be obtained by a proceſs ſtill more ſimple, ſtrong coction in water.

II. EUPHORBIUM.

THE ſtalks of the common Spurges bleed, on being wounded, a milky juice, in taſte acrimonious and burning. The EUPHORBIUM plant (ſuppoſed to be ſo called from its firſt diſcoverer Euphorbus, phyſician to Juba, and brother to Antonius Muſa) is nearly allied to the Spurges, in the flowers, the fruit, and the juice: The principal differences are, that the milk of the Euphorbium is more fiery, the ſtalks thick, fleſhy, and angular, with ſharp prickles ſet along the prominent angles.

There are many different ſpecies of the Euphorbium plant, natives of Africa, and preſerved in Europe in the hot-houſes of the curious. Whether the officinal Gummy-reſin of that name is extracted from one particular ſpecies, or from ſeveral promiſcuouſly, is uncertain: It is commonly ſuppoſed to be the produce, chiefly of that called by Breynius *Euphorbium cerei effigie*, &c. Euphorbium reſembling the Cereus or Torch-thiſtle, with thicker ſtalks armed with ſtrong ſpines: What Ray calls the true Euphorbium of the ancients, is the ſpecies deſcribed in the *Hortus Malabaricus*, there named *Schadidacalli*, and by Breynius *Euphorbium Indicum*, &c. that is, Indian Euphorbium reſembling the Opuntia or prickly Pear, with a triangular jointed ſtalk.

The juice is extracted by wounding the ſtem in different parts; pieces of ſheep-ſkin being previouſly

EUPHORBIUM.

tied round near the bottom, to prevent its running down upon the ground: The inciſions are made with a long handled inſtrument, that the operator may receive no injury from the cauſtic liquor ſpurting upon the face, *&c.* The juice concretes into roundiſh, ſemitranſparent whitiſh tears, which for the moſt part are internally hollow: Theſe are the Euphorbium brought to us. We commonly find bits of the ſtalk, prickles, and ſeeds of the plant intermixed, and not unfrequently ſmall ſtones and ſand. The whitiſh or pale yellowiſh tears are preferred, as being the freſheſt; the browner or darker-coloured they appear, the longer they have been kept.

Euphorbium is in taſte extremely acrimonious: The ſlighteſt touch burns and corrodes the tongue: Received in ſmall quantity into the noſe, it occaſions violent ſneezing: The utmoſt caution is requiſite in pulverizing it, to guard the eyes, noſe, and mouth from the pernicious effects of the fine duſt that flies off.

The acrimony of Euphorbium ſeems to reſide in the more ſubtile parts of the Reſin, which are extracted wholly by Spirit of Wine, and almoſt wholly by Water, the Reſin and Gum being nearly in equal proportions. An ounce of Euphorbium yielded five drams of ſpirituous extract; and another ounce gave juſt the ſame quantity of watery extract: Both the extracts were like the Euphorbium itſelf, fiery and corroſive, the ſpirituous moſt ſo. The three drams left undiſſolved by ſpirit, gave out two drams to water; and the three drams left undiſſolved by water, gave out two drams to ſpirit, the impurities in both caſes amounting to one dram: Both theſe ſecond extracts had little taſte, even the ſpirituous ſcarcely diſcovered any acrimony till long chewed. Nothing aroſe in diſtillation with either water or ſpirit.

Euphorbium was given internally by the ancients, in very conſiderable doſes, as a purgative, for evacuating water and black bile. No leſs than a ſcruple, a dram, and even two drams, are ſaid to have been taken at once; whereas at preſent, a few grains are

EUPHORBIUM.

found to operate violently both upwards and downwards, to inflame and corrode the ſtomach and inteſtines, and bring on convulſions. In ſome caſes it may be ſafely mixed in very ſmall quantity as a ſtimulus with other purgatives; but by itſelf it is never to be ventured on; nor are the corrections of it with Acids, Alkalies, expreſſed Oils, Gums, *&c.* of much importance. The moſt effectual method of correcting it would be to ſeparate the cauſtic matter by digeſtion in water or ſpirit, and employ only an extract made from the reſiduum by the contrary menſtruum. The principal uſe of Euphorbium is for external purpoſes, particularly in caries of the bones, the Spina ventoſa, ſcirrhous tumours, for taking off warts, as an ingredient in ſtimulating applications and bliſters, and among the farriers. Some employ a mixture of it with a large proportion of Florence Orris-root, or a decoction of it in water as a ſternutatory; a practice by no means to be approved.

III. SCAMMONY.

THE plant which produces SCAMMONY is a ſpecies of Convolvulus or Bindweed, with white flowers, oblong triangular leaves, and large thick roots. It was acknowledged by the ancients as a plant of the Convolvulus kind, but Moriſon was the firſt who gave it that name: He calls it *Convolvulus Syriacus & Scammonia Syriaca*; and in this he is followed by Tournefort and later botaniſts. It is a native of different parts of Aſia; that which grows in Syria and the neighbourhood of Aleppo affords the beſt Scammony; that of Smyrna and Myſia an inferior kind. The juice is ſaid to iſſue ſpontaneouſly from wounds made in the root, and to be exſiccated in the ſun or other gentle heat: Some ſuſpect, that it is extracted by expreſſion. (*n*).

The

(*n*) *Scammony.*] The publick is obliged to Dr. Ruſſel for an exact drawing and deſcription of the plant which yields Aleppo Scammony, and the manner of collecting the juice, taken upon the ſpot, and communicated in the medical obſervations and inquiries publiſhed by a Society of Phyſicians in London.

The plant, he informs us, agrees in its characters of fructification with the *Convolvulus*, as deſcribed by Linnæus in his *Genera plantarum*,

except

SCAMMONY.

The Aleppo or beſt Scammony is in fine, ſmooth, ſomewhat gloſſy maſſes, of a grey colour, a ſpongy texture, not very heavy, eaſily friable, of a diſagreeable ſmell, and a bitter nauſeous taſte: Powdered it

appears

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except in the number of ſeeds, which Linnæus confines to two, whereas there are oftener three, and ſometimes four in the Scammony. The ſtalks are round and pliant, about the ſize of a ſmall gooſe quill, and run out either on the earth, or on ſhrubs, or on ſuch other ſupport as they meet with, to fifteen or twenty feet or more: From theſe ſpring ſmaller branches, at unequal diſtances, of little leſs extent than the main ſtalks. The leaves grow upon the branches irregularly; they are thin, ſoft, of a bright green colour, about an inch and three quarters broad in the wideſt part, and grow narrower from thence gradually to a point; the part next the ſtalk has on each ſide of the pedicle, two ſemicircular notches or engrailures, one deeper than the other. The flowers grow upon a ſlender erect ſtem, about ſix inches long, divided near the top into two ſmall pedicles, each ſupporting a ſingle flower, of a pale yellow colour, of the ſhape of a bell with its brim turned outwards, and undivided. Theſe flowers begin to be ſent off within about two feet from the root, and continue through the whole length of the plant; their great number and erect ſituation above the leaves affords an agreeable appearance.

The root is generally from three to four feet long, and about as many inches in diameter, covered with a pretty thick aſh-coloured bark. Its inner ſubſtance is of a white colour, and manifeſtly conſiſts of two parts, a number of ſtrong woody fibres running lengthwiſe, and ſmall bundles of veſſels which contain a milky liquor, running in the interſtices of the others. Upon cutting the root tranſverſely, this ſtructure is very viſible, the ſap-veſſels being eaſily diſtinguiſhed by their yellow colour and ſpongy texture; in young roots, the open mouths of theſe veſſels are clearly diſcernible by the naked eye.

This plant grows naturally on all that chain of mountains which extends from Antioch to mount Libanon, and on that part of mount Taurus which is near to Maraaſh; probably it might be found alſo on moſt of the hills in Syria that afford any verdure. It flowers in May; the peaſants collect the Scammony in the beginning of June: Having cleared away the earth from the upper part of the root, they cut off the top in an oblique direction, about two inches below where the ſtalks ſpring from it: Under the moſt depending part of the ſlope they fix a ſhell, or ſome other convenient receptacle, into which the milky juice gradually flows. In twelve hours, the whole of the juice is drained off, to the quantity of only a very few drams from one root. The juice from ſeveral roots is put together, and in a little time hardens into Scammony.

It is the root only that produces this concrete; for the ſtalks and leaves near the root, even when preſſed, afford no ſigns of a milky juice. At the ſuperior extremity of the plant, the leaves and ſtalks when ſtrongly preſſed, do emit a very thin milky liquor; but its quantity is inconſiderable, and according to the beſt obſervation that Dr. Ruſſel could make, its quality is different; for neither the ſtalks, leaves, flowers nor ſeeds ſeemed to have any purgative virtue.

Of this entirely pure Scammony very little is brought to market, the greateſt part of what is to be met with being adulterated, if not by thoſe

who

appears of a bright grey colour: On the contact of watery moiſture, it becomes milky. The Smyrna or inferior Scammony, the ſort which for ſome years paſt the ſhops have been chiefly ſupplied with, is of a dark blackiſh-grey or browniſh colour, more impure, more ponderous, of a cloſe compact texture, and does not appear ſo white when moiſtened. Of either ſort we ſhould examine the internal part of the maſs, particularly of the large ones: I once found a piece of Lead incloſed.

SCAMMONY.

The Aleppo Scammony contains more Reſin and leſs Gum than that of Smyrna. An ounce of Smyrna Scammony yielded with water juſt half an ounce of gummy extract: The reſiduum yielded with ſpirit two drams of Reſin, leaving two drams of impurities undiſſolved. On inverting the procedure, and applying rectified ſpirit at firſt, I obtained from an ounce, two drams and two ſcruples of reſinous extract, and from the reſiduum half an ounce of Gum, the indiſſoluble part amounting here to only four ſcruples. The watery infuſions, whether made from the Scammony at firſt, or after ſpirit had performed its office, were extremely mucilaginous, ſo as to be difficultly reduced to a dry conſiſtence. Nothing aroſe in diſtillation with either water or ſpirit, except

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who gather, by thoſe who buy it of them, with wheat flower, aſhes, or fine ſand, and ſometimes with ſome other ingredient (poſſibly the expreſſed juice) which makes it very hard and difficult of ſolution. The notion of its being adulterated with the juice of Spurges ſeems to be a miſtake; for the doctor informs us that he has always found the purgative quality to be ſtrongeſt in pure Scammony, and weaker in the adulterated ſorts.

Pure Scammony is light, ſhining when broke, and crumbles with the leaſt force on being rubbed betwixt the fingers. If a wetted finger but touches it, it turns immediately milky; and if broke and put into a glaſs of water, it ſoon diſſolves into a milky liquor of a greeniſh caſt; which, though it lets fall a ſediment after ſome little time, yet ſtill retains its milky colour.

The colour of Scammony ſeems to be no mark of its purity; for the doctor ſays he has ſeen it in all the degrees, from almoſt a jet black to a yellowiſh white, and all equally good. But though it differs ſo much in colour when in large pieces, yet all good Scammony when powdered, is nearly of the ſame browniſh white colour.

The Scammony plant has been raiſed in England, from ſeeds procured by the gentleman from whom this account is taken; and found to flouriſh in the open ground, with all the marks of vigour.

SCAMMONY. that the diſtilled water diſcovered a faint kind of ſmell.

Boulduc informs us, in the French Memoirs for the year 1702, that from four ounces of Aleppo Scammony he obtained one and a half of watery extract, and from the reſiduum two ounces of ſpirituous extract; that from the ſame quantity, he obtained with Vinegar two ounces and two drams of extract, and from the reſiduum, with rectified ſpirit, ten drams; and that on applying rectified ſpirit at firſt, he had three ounces of reſinous extract from four of Scammony.

Scammony is one of the more powerful cathartics. Some have looked upon it as being truly virulent, and contrived ſundry methods for correcting or rendering it milder: The only correction now in uſe is expoſing the powdered Scammony to the fumes of burning Sulphur: Thus prepared, it is called *Diagrydium*, (properly *Dacrydion*, i. e. *Lacrymula*) *ſulphuratum*. Neither this, however, nor the other corrections, by treating it with juices of different plants, moiſtening it with Spirit of Vitriol, baking it in a ſcooped quince incloſed in dough, &c. are at all neceſſary. Scammony itſelf, or its pure Reſin in the doſe of ſix grains, duly divided and diſſolved or rendered ſoluble in watery liquors by trituration with Almonds and Sugar, may be given with ſafety where ſtrong kinds of purgatives are required. Extracts made from Scammony with decoction of liquorice, and with water actuated with fixed alcaline Salt, are greatly commended by Boulduc, particularly the latter, as being the mildeſt and beſt preparations obtainable from this Gummy-reſin.

ALOES. ALOES is a bitter juice extracted from the leaves of a plant of the ſame name. The Aloe plant has very juicy, thick, fleſhy leaves, and liliaceous flowers: Many different ſpecies of it grow ſpontaneouſly in the Eaſt and Weſt-Indies, and are cultivated in botanic gardens in Europe. The officinal Aloes is commonly ſuppoſed to be the inſpiſſated juice of the leaves: I hold it to be rather a true extract, or if it is

Aloes.

in ſome places prepared by inſpiſſating the juice, yet that this juice is obtained by cutting, bruiſing, and preſſing the leaves.

Three ſorts of Aloes are diſtinguiſhed in the ſhops, by the names of *Aloe ſoccotorinâ*, *ſuccotrina*, or *zoccotrina*, *Aloe hepatica*, and *Aloe caballina*. The epithet Soccotrina is taken from the iſland Zocotora, *Hepatica*, from the liver colour, and *Caballina*, from the uſe of this ſpecies being confined to horſes. The Succotrine Aloes is the beſt, the Hepatick next in goodneſs, and the Caballine the worſt. Formerly there was a kind of Aloes called *Lucida*, ſuperior to all the others: This was ſemitranſparent, and doubtleſs prepared from the pure juice extracted without any conſiderable preſſure. At preſent we meet with none of this ſort, and we muſt be contented with the ſuccotrine and hepatic. Theſe differ from one another only in degree of purity (*o*); and even in this reſpect they are often ſo much alike, that it is not eaſy to diſtinguiſh them. For pharmaceutical and medicinal purpoſes, it is indifferent whether we take one or the other, the Hepatic being as good as the Succotrine, provided it is not viſibly foul or droſſy; at leaſt I have never been able to find any real difference betwixt them in quality. The principal characters of good Aloes are theſe. It muſt be gloſſy, not very black, but brown; when chewed, rubbed or

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(*o*) *Aloes, different in purity.*] The three ſorts of Aloes differ not only in degree of purity, but in ſmell, and appear to be obtained from three different ſpecies of the Aloe plant. The bitter juice reſides in diſtinct veſſels ſpread through the ſubſtance of the leaves; the fleſhy part of the leaf has a glutinous ſweetiſh taſte, with little or no bitterneſs.

The aloetic juice is ſaid to be extracted, by plucking the leaves and ſhaking them gently downwards, or by cutting and bruiſing them, and ſuffering them to ſtand for three weeks or longer, when the bitter juice is found to have ſeparated, the lighter feculencies ariſing to the ſurface, and the groſſer falling to the bottom. The juices are afterwards inſpiſſated by the heat of the ſun, to the conſiſtence in which they are brought to us.

It is probable, that the Socotorine aloes is prepared by the firſt of theſe proceſſes, and the Hepatic and Caballine by the laſt; and that after ſtanding for the time limited, the juice is ſtrained through haircloths. The impurities obſerved upon breaking a lump of Hepatic or Caballine Aloes are hairs and bits of ſkins; but thoſe of the Socotorine are gravel and ſmall ſtones.

Aloes. or cut, of a yellow colour; compact, but eaſy to break; eaſily ſoluble; of an unpleaſant ſmell, and an extremely bitter taſte. Such as is black, firm, and hard to break, we may ſuſpect to be adulterated.

The gummy and reſinous matter in Aloes are very intimately blended together, inſomuch that either watery or ſpirituous menſtrua applied ſeparately, diſſolve greateſt part of both. Out of ſixteen ounces of Aloes, rectified Spirit of Wine diſſolved near fifteen ounces: From the reſiduum water took [illegible] dram, about an ounce of impurities being left. On inverting the procedure, and applying water at firſt, I obtained but thirteen ounces and a half of watery extract, and from the remainder one ounce and a half of reſinous: From whence it follows, that Spirit of Wine is the natural menſtruum for Aloes, as it diſſolves out of ſixteen ounces an ounce and a half more than water does. It appears further, that the common opinion, that water extracts all the gummy part and leaves all the reſinous, is erroneous, though on this principle depends the common proceſs of waſhing Aloes, or preparing from it a watery extract, with a view to wholly ſeparate the ſuppoſed hurtful Reſin. Whether the watery or ſpirituous extracts are beſt, can be determined only by experience. I imagine, the difference betwixt them will not be found to be great. Both the extracts and Aloes in ſubſtance are purgative; and if uſed too freely, are apt to occaſion great heat and ebullition of the blood, and diſpoſe to hæmorrhoidal complaints.

Aloes is an ingredient in many officinal compoſitions, particularly in the pills. One of the moſt common preparations of it is the *Aloe lota* or *depurata*. This is made by digeſting or gently boiling good ſuccotrine Aloes with a proper quantity of water, filtering the ſolution, and inſpiſſating it by the heat of a water-bath to the conſiſtence of an extract, or to ſuch a thickneſs that it may be fit for making into pills. If this extract (for it is truly ſuch) be made, inſtead of common water, with the expreſſed juice of

Violets

ALOES.

Violet flowers, it is called *Aloe violata*; and with the expreſſed juice of Roſe leaves, *Aloe roſata*. When the *Aloe violata* is mixed with half its weight of Creme of Tartar, the compound is named *Aloe violata tartarea*. If the *Aloe roſata* be diſſolved in a good quantity of the freſh juices of Roſes, Violets, Borage and Bugloſs mixed in equal proportions, and afterwards reduced by evaporation to its former conſiſtence, the extract thus prepared, is called *Aloe inſuccata*, and with the addition of one third its weight of Creme of Tartar; *Aloe inſuccata tartarizata*. Aloes extracted with a mixture of diſtilled Vinegar and Roſe-water, and afterwards inſpiſſated, is the *Cholagogue extract* of Andernacus: Treated in the ſame manner with rectified Spirit of Wine, it yields the reſinous extract called *Balſam of Aloes*. If only a moderate quantity of rectified ſpirit be uſed for the extraction, the filtered tincture is called with propriety *Eſſence of Aloes*. Aloes is alſo the baſis of the *Elixiria proprietatis*, ſeveral compoſitions of which may be ſeen in Diſpenſatories. The beſt method of making theſe preparations is, to extract a tincture from each of the ingredients ſeparately, and then mix the three tinctures together: By this method the elixir will turn out thicker, ſtronger, and more ſaturated than when all the ingredients are digeſted in the menſtruum together: It is of advantage alſo to employ for the menſtruum, not a highly rectified but a phlegmatic ſpirit, eſpecially for the Saffron and Myrrh.

It is obſervable that Eſſence of Aloes ſtains the glaſs wherein it has been kept for ſome time, of a deep red colour, covering it as it were with a coat of a fine tranſparent varniſh, which no other eſſence does. Mr. Geoffroy of Paris endeavoured to perſuade me, that the red tincture on the glaſſes wherein Elixir proprietatis is kept, proceeded from the Myrrh and not from the Aloes: But on trying Eſſences of Myrrh and Aloes ſeparately, the Eſſence of Myrrh never ſtained the glaſs, whilſt that of Aloes always did.

ALOES. Some take the watery extract of Aloes, add to it a portion of *Terra foliata tartari*, and digeſt the mixture in Spirit of Wine: This preparation is called *Elixir purgans*. If ſixteen ounces of Aloes, two ounces of Myrrh, and half an ounce of Frankincenſe be pulverized, mixed together, and diſtilled in a ſand heat in a low glaſs body, there ariſes an Oil called *Oleum Aloes purgans*. The *Angelic* and *Frankfort pills*, of common uſe as laxatives, conſiſt either of the Aloe violata, or of Aloes mixed with a ſmall portion of other purgatives: Some add a little Scammony, others diſſolve the Aloes in an infuſion of Sena. Aloes is employed alſo for external purpoſes, as a balſamic and vulnerary.

V. OPIUM. ON wounding the heads or ſtalks of the Poppy, a milky juice exudes, which exſiccated proves a fine kind of OPIUM. In Natolia, Cilicia, Cappadocia, in the neighbourhood of Cairo, and in ſeveral other parts of the Turkiſh dominions, Poppies are cultivated for this uſe in fields, as Corn among us. The method of collecting the juice by inciſion is deſcribed by Kæmpfer in his *Amœnitates exoticæ*. This proceſs, however, is now but rarely practiſed; the conſumption of this drug being too great to be ſupplied by that method of collection. The beſt ſort of the officinal Opium is the expreſſed juice of the heads, or of the heads and the upper part of the ſtalks inſpiſſated by a gentle heat: This was formerly called Meconium, in diſtinction from the true Opium or juice which iſſues ſpontaneouſly. The inferior ſorts (for we find conſiderable differences in the quality of this drug) are ſaid to be prepared by boiling the plant in water, and evaporating the ſtrained decoction: But as no kind of our Opium will totally diſſolve in water, the juice is moſt probably extracted by expreſſion. I have been informed, by ſome Turks at Genoa and Leghorn, that in ſome places the heads, ſtalks and leaves are committed to the preſs together,

ther, and that this juice inſpiſſated affords a very good Opium (*p*).

OPIUM.

Opium is brought not only from Turkey, but from Perſia and the Eaſt-Indies, incloſed in leaves; the two laſt ſorts are more impure than the firſt, and greatly inferior in quality. The largeſt quantities come from Alexandria, Smyrna and Aleppo: Some of the dealers in this commodity diſtinguiſh the beſt Opium by the name of *Opium cabaiſanum*, from its coming over in calabaſhes or gourd-ſhells like Aloes and ſome of the Balſams. The principal marks of the goodneſs of Opium are, its diſcovering internally no viſible impurities, its appearing when broke, in ſome degree bright, and of a dark reddiſh-black colour, approaching to that of Aloes, its being dry, not ſoft or unctuous, moderately ponderous and compact, inflammable, of an acrid bitter taſte, and a faint ſmell like that of unripe Poppy-heads, without any thing of an empyreumatic flavour, and its communicating to water not a yellow but a reddiſh tincture.

With regard to the chemical hiſtory of this extraordinary concrete, its component parts, like thoſe of other vegetable ſubſtances, have been generally aſſigned from the reſult of deſtructive analyſes by fire; and it is truly wonderful, ſoporific and anodyne virtues, aſcribed to principles which naturally have no exiſtence in it, as volatile Salts, Sulphurs, empyreumatic Oils, *&c.* The particular matter on which its aſtoniſhing effects depend, has not hitherto been exhibited in a ſeparate or perfectly pure ſtate; but that matter, whatever it may be, it is in the power of chemiſtry to acuate and concentrate, to obtund and to deſtroy.

The principles ſeparable from Opium are, a Reſin, Gum,

(*p*) *Opium procured by expreſſion, &c.*] This point has not as yet been fully determined. It is commonly ſuppoſed, that whatever preparations the Turks may make from the Poppy for their own uſe, the Opium brought to us is really the milky juice collected from inciſions made in the heads, as deſcribed by Kæmpfer. It is certain, that an extract made by boiling the heads, or the heads and ſtalks in water, is much weaker than Opium; but it appears alſo that the pure milky tears are conſiderably ſtronger.

OPIUM.

Gum, a minute portion of ſaline matter, water and earth. The Reſin is of two kinds, one more truly reſinous, of a ſolid conſiſtence, in its nature more fixed, and in its operation more ſluggiſh; the other ſofter and thinner, more volatile, and of much more ſpeedy and powerful activity. The ſaline matter is of the acidulous kind, analogous to the eſſential Salts of other vegetables: Its proportion is ſo ſmall, that it is not eaſily ſeparable in its proper form, though it has ſometimes happened, that actual cryſtals have concreted in a watery ſolution of Opium. The Reſin, the Gum, and the Salt, are very intimately combined together, inſomuch that all the three diſſolve almoſt equally in water and in ſpirit: It is probably to the ſaline principle, in this and other vegetables, that this intimacy of union is in great meaſure to be aſcribed.

Four ounces of Opium, treated with highly rectified Spirit of Wine, yielded three ounces and four ſcruples of reſinous extract: The reſiduum, dried and treated with water, yielded only four ſcruples of gummy extract, five drams and a ſcruple of indiſſoluble impurities remaining. On taking four ounces more, and applying water at firſt, I obtained two ounces five drams and one ſcruple of gummy extract; and by digeſting the reſiduum in Spirit of Wine, three drams and one ſcruple of reſinous extract, the indiſſoluble part amounting here to ſeven drams and a ſcruple. In diſtillation, rectified ſpirit brought over little or nothing; but the diſtilled water was conſiderably impregnated with the particular ill ſmell of the Opium.

The ſubtile ſoft kind of reſinous matter diſcovers itſelf in great meaſure, in the bare watery ſolution of Opium, generally ariſing to the ſurface in form of a fat unctuous, frothy ſubſtance. This is the ſtrongeſt and moſt active part of the Opium; a few grains are ſufficient to kill a dog, who could bear a whole dram of crude Opium. From a pound of Opium, we may collect two or three drams of this balſam-like ſubſtance; but we are not to imagine that this is the

whole

Opium.

whole quantity which the Opium contains: Beſides what thus ſpontaneouſly ſeparates, a part remains combined with the reſt of the juice, and probably is the principle, or the direct ſeat of the principle, that gives activity to the whole.

As Opium in ſubſtance is frequently found to be productive of unfavourable conſequences, different methods have been contrived for correcting or rendering it more univerſally ſafe. In this enquiry, every one has proceeded agreeably to the idea he had formed of the compoſition of Opium, and endeavoured to counteract that principle, in which he imagined its activity to conſiſt: Hence the great variety of pretended correctors. Thoſe who aſcribed its powers to a volatile alcaline Salt, thought to mitigate it by acids, as Spirit of Vitriol, dulcified Spirit of Vitriol, Citron juice; whilſt others, deducing its operation from an acid, uſed alcalies for the correctors. Some, preſuming it to be of a cold nature, joined to it hot ſubſtances, as Cinnamon, Pepper, Ginger, Euphorbium, *&c.* theſe kinds of additions accompany it in the ancient electaries, and as moſt electaries formerly received Opium in their compoſition, *Opiatum* became a general name for the form itſelf. Some, imagining Opium to be impregnated with a narcotic Sulphur, endeavoured to diveſt it of that offending principle, by cutting it into thin ſlices, and gently roaſting it till it begun to ſmell agreeably; Others, afraid that this degree of torrefaction was inſufficient for the total diſſipation of the Sulphur, had recourſe to a ſtronger heat, and deſtroyed the Opium and all its powers by burning. On what principle Henbane ſeeds and other ſtupefactive bodies were joined to Opium, it is hard to gueſs.

For my part, I am perſuaded, that the narcotic matter of Opium is diffuſed throughout its whole ſubſtance; but that it reſides moſt copiouſly, and in the moſt eminent degree, in its finer, ſubtile, volatile parts; that theſe parts are capable of being highly concentrated and exalted in their power by art; I know myſelf a certain preparation of Opium, by

Opium. which a whole chamber full of men may be preſently ſtupefied, and deprived of their ſenſes, and even of their lives alſo, without a ſingle grain being ſwallowed; that the narcotic matter cannot be ſeparated in any viſible form, without ſome admixture of the other parts; that Opium cannot be totally freed from it, but by a deſtruction of the Opium itſelf, that it operates nearly in the ſame manner as the vapour of burning Charcoal, or the ſubtile exhalations from fermenting liquors. To diſſipate a part of this volatile principle, and thus render the Opium more mild and innocent, I know of no method more effectual than fermentation.

The Opium for this purpoſe, is to be macerated in water without heat, the ſcum which ariſes on the ſurface carefully taken off, the liquor decanted from the undiſſolved part, paſſed through a ſtrainer, ſet in a warm but not cloſe place, with the addition of ſo much Sugar as will diſpoſe it to ferment, in a veſſel covered only ſo as to keep out duſt: By ſtirring the whole well together, when it has ceaſed to ferment, a freſh fermentation may be excited: I have thus continued the proceſs, in England, for three quarters of a year together. When a little of the liquor, ſet in a gentle warmth, in a cloſe ſtopt vial, neither burſts the glaſs, nor diſcovers any expanſive force upon drawing the cork, the fermentation is completed: The liquor is now to be ſtrained or filtered, and evaporated to the conſiſtence of an extract. This is one of the beſt preparations of Opium, and was greatly uſed in England during my reſidence there. It differs from Langelot's *fermentum anodynum* in the ſubſtitution of water to Quince juice, and the omiſſion of Salt of Tartar; by which variations, the fermentation ſucceeds better and continues longer, and the reſinous parts are more effectually ſeparated. If this extract is required to be ſtill more mild, it may be diſſolved afreſh in a large quantity of water, and kept for a time ſtrongly boiling in a broad open veſſel (*q*).

As

(*q*) *Correction of Opium by fermentation.*] Theſe kinds of preparations are grown, among us, entirely into diſuſe, and very juſtly. It is a point

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As the reſolution of Opium is greatly promoted by heat, we muſt be cautious in the uſe of diſtilled waters and ſpirits in which Opium is an ingredient: We are particularly to avoid making any diſtillation from it when in actual fermentation. A certain phyſician greatly commends a compound Opiate ſpirit as a moſt noble and approved anodyne; and a mixture of Opium with acrid Tincture of Antimony, as a powerful and ſafe diuretic: In another piece, however, publiſhed not long after, thoſe and other preparations of Opium are by the ſame gentleman condemned. There are various extracts of Opium made with Water, Spirit of Wine, Vinegar, &c. Wedel ſays, he makes his extract with the Lixivium or Water that remains in the preparation of the *Terra foliata Tartari*: I know of no Lixivium remaining in that proceſs, the *Terra foliata* being obtained, not by cryſtallization, but by the total evaporation of the liquor: Probably he means a ſolution of the *Terra foliata* itſelf.

OPIUM.

I ſhall conclude this article with ſome practical cautions in regard to the uſe of Opium, drawn from experience: (1.) That neither crude Opium, or its reſinous extract ſhould be given by themſelves, in pills or other forms: Starkey's pills are found to anſwer much better than Opium alone. (2.) That the extract I have recommended, be given rather in a liquid than in a dry form, as in the firſt it operates more expeditiouſly and with greater ſafety. (3.) That tinctures or extracts made with rectified ſpirit are moſt prudently abſtained from. (4.) That thoſe preparations are to be uſed with great circumſpection, which have been made by bare digeſtion, or by an imperfect fermentation. (5.) That a very ſmall quantity of my fermented extract, mixed in glyſters, produces excellent effects in convulſive and painful diſorders, particularly in the nephritic

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of primary conſequence, in preparing a medicine of ſuch activity as Opium, that it be always made of equal and certain ſtrength: Fermentation, if it really weakens the power of the Opium (as it probably does) muſt for that very reaſon render its ſtrength vague and impoſſible to be aſcertained. It does not appear, that the corrections of Opium by fermentation or other like proceſſes, do any thing more than what may be equally effected by a dimunition of the doſe.

OPIUM. colic. (6.) That Opiates in general, as they are capable, when properly exhibited, of anſwering the moſt valuable purpoſes in medicine, ſo on the other hand, when given imprudently, they are apt to be productive of dangerous conſequences where they do not prove directly fatal.

VI. GUM. HEDERÆ. GUM HEDERÆ is commonly ſuppoſed to be the produce of the *Hedera Arborea* or Tree-ivy. Lemery ſays expreſsly, that it exudes from inciſions made in the trunk of that plant, and that the peaſants collect it therefrom in Italy, Provence and Languedoc: Pomet affirms, that he has collected it himſelf from the *Hedera* at Montpelier. This account, however, is ſomewhat doubtful. Though I made great enquiry, in my travels, after the parent of this gummy Reſin, I never could procure any ſatisfactory information All I could learn was, that the greateſt quantities came from the furthermoſt parts of the kingdom of Naples, and from Sicily: Of the plant which afforded it, I could hear nothing; to the botaniſts of Italy it was unknown.

This gummy Reſin is of a bright, tranſparent, reddiſh brown colour, deeper than the Hyacinth, and approaching to that of the Garnet; when reduced to powder, of a ſaffron yellow; of an agreeable aromatic taſte and ſmell. Such is the genuine Gum Hederæ. In the ſhops, we frequently meet with different ſophiſticated mixtures under this name; by theſe probably thoſe authors have been miſled, who deſcribe Gum Hederæ as of a blackiſh colour, of no ſmell, of an acrid aſtringent taſte, too corroſive for any internal uſe, and fit only for external purpoſes, ſuch as the deſtroying of inſects. The true Gum Hederæ has no corroſiveneſs or acrimony, and may be given inwardly with great ſafety, as it frequently was by Stahl, Becher, and many others. It has an advantage above all the other known gummy Reſins, that it does not occaſion any heat or ebullition of the blood; and proves an excellent and ſafe reſolvent and corroborant, in a viſcid ſtate of the juices, in cachexies, chloroſes, and menſtrual obſtructions.

An ounce of choice Gum Hederæ yielded, with

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rectified Spirit of Wine, five drams and an half of reſinous extract; from the reſiduum I obtained by Water half a dram of gummy extract; and two drams of indiſſoluble matter. Another ounce, treated firſt with Water, gave two drams of gummy extract; and afterwards, with ſpirit, three drams two ſcruples of reſinous extract; two drams and half a ſcruple remaining undiſſolved. The diſtilled ſpirit has a ſlight taſte of the Hederæ; the diſtilled Water is conſiderably impregnated both with the taſte and ſmell, and diſcovers on its ſurface a ſmall quantity of eſſential Oil, which is found on taſting to be leſs hot than the other Oils of that claſs. GUM HEDERÆ.

VII. SARCOCOLLA.

SARCOCOLLA is a gummy Reſin brought from the Oriental countries: Neither the plant which produces it, nor the place of its production, are with certainty known. The beſt Sarcocolla is in ſmall tears, about the ſize of peas, of a whitiſh or pale yellowiſh colour, of a ſpongy texture, very brittle or rather crumbly, ſomewhat unctuous, eaſy of ſolution in Water, of no ſmell or only a ſlight reſinous one, of a bitter taſte intermixed with a ſweetneſs like that of liquorice, but upon the whole is not very agreeable. The whiter and bitterer, the freſher and better it is. Greateſt part of what we meet with in the ſhops is in a powdery form, the friable tears being probably rubbed into powder in the carriage. We ſometimes find among it large maſſes of a vermillion red, and others of a browniſh colour, compoſed evidently of ſmaller pieces joined together, with marks on the outſide like the impreſſion of a mat.

Out of an ounce of Sarcocolla, rectified Spirit of Wine diſſolved ſix drams: of the remainder, Water took up only two ſcruples; two ſcurples and an half being left undiſſolved. Water applied at firſt to another ounce, diſſolved ſeven drams and an half: from the remainder, ſpirit took up twenty-ſix grains; ſcarcely eight grains being left. The gummy parts therefore prevail, in this concrete, above the reſinous. In diſtillation, neither Water nor Spirit bring over any remarkable ſmell or taſte—— The uſe of this gummy

SARCOCOLLA. Reſin is only as an ingredient in ſome external applications. It has been ſuppoſed to conglutinate wounds, whence its name *Sarcocolla* or Fleſh glue.

ASAFOETIDA. ASAFŒTIDA, *Sylphium*, *Laſerpitium*, Devil's dung, ſo called from its ſtinking ſmell, is obtained from a large umbelliferous plant, deſcribed by Kæmpfer as of the Lovage kind, with leaves like thoſe of Peony, and leafy ſeeds like thoſe of Parſnep; growing in Perſia, particularly in the province Choraſan about Heraat, and in the province Laar near Congo and Diſguun; not in Media, Libya, Syria or Cyrene, though ſome, from an opinion that it was the produce of this laſt country, have called the juice *Succus Cyrenaicus.*

The root of the plant reſembles a large Parſnep, externally of a black colour: On cutting it tranſverſly, the Aſafœtida exudes, in form of a white thick juice like cream, which from expoſure to the air becomes yellower and yellower, and at laſt of a dark brown colour: It is very apt to run into putrefaction, and hence thoſe who collect it, carefully defend it from the ſun. The freſh juice has an exceſſively ſtrong ſmell, which grows weaker and weaker upon keeping: A ſingle dram of the freſh fluid juice ſmells more than an hundred pounds of the dry Aſafœtida brought to us: The Perſians are commonly obliged to hire ſhips on purpoſe for its carriage, as ſcarcely any one will receive it along with other commodities, its ſtench infecting every thing that comes near it.

The common Aſafœtida of the ſhops is of a yellowiſh or browniſh colour, unctuous and tough, of an acrid or biting taſte, and a ſtrong diſagreeable ſmell, reſembling that of Garlic. From four ounces I obtained, by rectified ſpirit, two ounces ſix drams and a half of reſinous extract; and afterwards, by Water, three drams half a ſcruple of gummy extract; about ſix drams and a ſcruple of earthy matter remaining undiſſolved. On applying Water at firſt, I gained, from four ounces, one ounce three ſcruples and a half of gummy extract. The ſame quantity yielded, with ſtrong French wine, two ounces and an half and fifteen

teen grains; from which about one fifth may be deducted for the ſolid matter contained in the Wine. Schroder ſays, that Aſafœdita may be diſſolved over the fire in Water, Vinegar, or Wine; but only a part of it can be diſſolved in any of theſe liquors. The ſmell of the Aſafœdita reſides wholly in an eſſential Oil, which ariſes in diſtillation both with Water and ſpirit: Four ounces, diſtilled with Water, yielded above a dram of Oil.

ASAFOETIDA.

IX. AMMONIACUM.

THE plant which produces AMMONIACUM, and the place of its production, are unknown. The beſt Ammoniacum is compoſed of white, whitiſh, or yellowiſh tears baked together into maſſes: The internal parts particularly are whitiſh: By age it becomes more and more yellow and brown. It eaſily ſoftens and becomes tough betwixt the fingers. Chewed, it diſcovers a bitteriſh, glutinous, not diſagreeable taſte. Its ſmell approaches to that of a mixture of Opopanax and Galbanum: Some reſemble it to that of Caſtor, others to that of Coriander-ſeeds, and others to that of Garlic.

It diſſolves almoſt equally in Water and Spirit. Out of an ounce of choice Ammoniacum, rectified Spirit of Wine diſſolved ſix drams: Water applied to another ounce, took up ſix drams two ſcruples and an half. From the matter left undiſſolved by ſpirit, Water took up five ſcruples and five grains: From that which Water left undiſſolved, rectified Spirit extracted a dram; the indiſſoluble part amounting in the firſt caſe to fifteen grains, in the latter only to half a ſcruple. In diſtillation, Spirit of Wine ariſes unchanged: The diſtilled Water has ſomewhat of a ſweetiſh taſte, and ſmells a little of the Ammoniacum, but gives no Appearance of any eſſential Oil.

Ammoniacum is accounted deobſtruent; promotes urine; and in large doſes, opens the belly. It is given particularly in obſtructions of the breaſt, in cachectic, hydropic, and apoplectic caſes, from a ſcruple to half a dram: It operates more effectually in a liquid form, as that of an emulſion, than in the ſolid one of pills; but is moſt commodiouſly taken in the latter

form.

AMMONIACUM.

form. It is ſometimes diſſolved in vinegar: Externally, it reſolves hard ſwellings. It is purified by diſſolving it in Vinegar, Wine, or Water, and ſtraining and inſpiſſating the ſolution.

X. BDELLIUM.

BDELLIUM is another gummy Reſin of which we do not know with certainty either the plant or the place of its production: It is ſuppoſed to be the produce of Africa. Lemery and Pomet have given fictitious figures of the plant, as the latter has done of many others. The beſt Bdellium is of a yellowiſh brown or dark brown colour according to its age, unctuous to the touch, brittle but ſoon ſoftening and growing tough betwixt the fingers, in ſome degree tranſparent, not unlike Myrrh, of a bitteriſh taſte, and a medorately ſtrong ſmell. It does not eaſily take flame, and when ſet on fire ſoon goes out: In burning, it ſputters a little, on account of its aqueous humidity, but cannot be ſaid to explode, much leſs to explode like gunpowder, as Hermann and Valentini report.

An ounce of picked Bdellium, treated with Water, gave ſix drams two ſcruples of gummy extract; and afterwards, with Spirit, two ſcruples of Reſin; two ſcruples remaining undiſſolved. Another ounce, treated firſt with rectified ſpirt, yielded two drams of reſinous extract; and afterwards, with Water, five drams two ſcruples of gum; only one ſcruple remaining undiſſolved. The diſtilled ſpirit has no taſte or ſmell of the Bdellium, and the diſtilled Water very little.

XI. GALBANUM.

GALBANUM exudes from an umbelliferous plant with leaves like thoſe of Aniſe, growing in the Eaſt Indies, but moſt plentifully in Syria and Arabia, called by Tournefort *Oreoſelinum Africanum, Galbaniferum, frutescens, aniſi folio.* This juice comes over in maſſes, compoſed of white, yellowiſh, browniſh yellow, and brown tears, unctuous to the touch, ſoftening betwixt the fingers, of a bitteriſh, ſomewhat acrid, diſagreeable taſte, and a very ſtrong ſmell, generally full of bits of ſtalks, leaves, ſeeds, and other foreign matters.

Lemery relates a pretty remarkable obſervation; that Galbanum, Sagapenum, Bitumen judaicum, and

Opo-

Galbanum.

Opopanax; ſubſtances whoſe ſmell is diſagreeable to every body, being tied in ſeparate parcels, in the quantity of half a pound of each of the three firſt, and a quarter of a pound of the laſt, and kept for ſome time in a pocket; they impregnated the clothes with a ſtrong and durable muſk ſmell. There are many inſtances of a mixture of fetids producing an agreeable ſcent; but I have not found that this mixture is one of them. I have repeated Lemery's experiment in the ſame manner as he deſcribes it, but not with the ſame event; and therefore preſume that the ſmell proceeded from ſome other cauſe.

Galbanum contains more of a reſinous than gummy matter: One pound yields with rectified Spirit of Wine, upwards of nine ounces and an half of reſinous extract; but the gummy extract obtained by Water from the ſame quantity amounts only to about three ounces. The Reſin is hard, brittle, inſipid and inodorous: The gummy extract has ſomewhat of a nauſeous reliſh, but could not be diſtingiſhed to be a preparation of Galbanum. The whole ſmell, flavour and ſpecific taſte of this juice reſide in an eſſential Oil, which ariſes in diſtillation both with Water and Spirit, and gives a ſtrong impregnation to both: From a pound of Galbanum are obtained, by diſtillation with Water, ſix drams of actual Oil, beſides what is retained by the Water. In this reſpect, Galbanum agrees with Aſafœdita, and differs from Ammoniacum.

The volatility of the active parts of this juice, renders the common method of purifying it, by ſolution, colature and evaporation, very injurious to it. The ſmell of the Galbanum is diffuſed, during the evaporation, over the whole houſe; and the inſpiſſated matter, whatever menſtruum was employed, is found to have loſt the diſtinguiſhing qualities of the original juice. To prevent as much as poſſible this inconvenience, the ſolution ſhould be made in a diſtilling veſſel, and after filtration, inſpiſſated in the ſame ſo long at leaſt as the liquor which diſtils has any ſmell or taſte; after which, the Galbanum may be reduced to a

GALBANUM. a due conſiſtence by further evaporation in an open veſſel, and the Oil which ariſes in the diſtillation mixed with it. Galbanum may likewiſe be purified, ſufficiently for inferior purpoſes, as plaſters, by expoſing it in winter to a ſtrong froſt till it grows hard, and then pulveriſing and ſifting it: The woody, ſtrawy, ſtony, and other like matters will be retained in the ſieve.

Galbanum diſtilled by a ſtrong fire without addition, yields, like other reſinous bodies, a large portion of empyreumatic Oil, amounting to upwards of eight ounces upon ſixteen: It is remarkable of the Oil of Galbanum, that great part of it appears of a blue colour, ſometimes of a deep bright blue, ſometimes of only a violet blue. The matter on which the blueneſs depends appears to be either very volatile or very changeable: It ſoon eſcapes or changes in the air, leaving, inſtead of the blue, a purple colour.

XII. OLIBANUM. OLIBANUM, *Thus*, Frankincenſe, comes chiefly from Arabia: But notwithſtanding its early and frequent uſe in fumigations, the plant which produces it is as yet unknown. The ancients diſtinguiſhed various ſorts of Olibanum, as 1. *Olibanum*, or *Thus maſculum*, *Melax*, *Melaſon*, *Teſticulatam*, or the pureſt, yellowiſh white, round tears, which were frequently joined two together. 2. *Thus fæmininum*, or the yellower and more impure. 3. *Thus mammoſum*, or larger oblong roundiſh maſſes, ſomewhat reſembling a woman's breaſts. 4. *Thus granuloſum*, or ſmall granules. 5. *Thus corticoſum*, or ſuch maſſes as have pieces of the bark of the tree adhering. 6. *Thus orobæum* or *Mica thuris*; ſmall fragments, or particles broke off in carriage, &c. 7. *Manna thuris*, the finer duſt. 8. *Thus indicum*, or large maſſes, compoſed of different coloured tears, white and blackiſh, joined together.

At preſent only two kinds are diſtinguiſhed: The finer and purer tears are called Olibanum in grains; the more impure fragments and maſſes, common Olibanum, or Olibanum in ſorts. The beſt is of a yellowiſh white colour, ſolid, hard, and brittle: Chewed

OLIBANUM.

for a little time, it renders the ſpittle white, and impreſſes an unpleaſant bitteriſh taſte: Laid on burning coals, it yields an agreeable ſmell.

Out of an ounce of the pure tears, rectified Spirit of Wine diſſolved five drams two ſcruples and ſix grains: From the remainder, Water took up two drams and five grains. Another ounce gave out to Water at firſt three drams and a ſcruple; and afterwards to Spirit, four drams thirty-three grains. The indiſſoluble matter, in the firſt operation, weighed twelve grains; in the other fourteen. Both the diſtilled Spirit and Water taſted pretty ſtrongly of the Olibanum, but no ſeperable Oil could be obtained—Olibanum is accounted corroborant, and ſuppoſed to be particularly ſerviceable in diſorders of the head, ſtomach and breaſt. Its principal uſe is in plaſters, unguents, &c. and in fumigations.

XIII. OPOPANAX.

OPOPANAX is the juice of an umbelliferous plant called *Panax* or All-heal. It has been generally ſuppoſed to be the produce of the ſpecies, called by Caſphar Bauhine *Panax ſphondylii folio ſive Heracleum*, Hercules's All-heal with leaves like thoſe of the Cow parſnep: But Ray affirms that it proceeds from a different one, the *Panax paſtinacæ folio*, or Parſnep-leaved All heal of the ſame author: This laſt is the ſpecies, which Dodonæus raiſed from the ſeeds found among the officinal Opopanax. The juice exudes from inciſions made in the roots and the lower part of the ſtalks. The greateſt quantities are collected in Syria, Bœotia, Macedonia, at Phocis in Achaia, as alſo in Lybia and Cyrene. The plant is found likewiſe in Sicily and Apulia; but we have no Opopanax from thence.

Opopanax, as we commonly meet with it, is of a browniſh colour on the outſide, and paler, inclining to yellowiſh within; the darker coloured, the older. It is in ſome degree ſoft or unctuous, yet eaſy to break; of a bitter taſte, and a ſtrong diſagreeable ſmell. There are ſome pure, firm, compact tears; But much the greater part is extremely foul, being blended throughout with bits of wood, ſtalks, leaves, &c. It is often ſo-

OPOPANAX. ſophiſticated; and in Holland, when it is dear, counterfeited by artificial compoſitions. Such as is black and very ſoft and clammy ſhould be rejected.

An ounce of Opopanax, treated with rectified Spirit of Wine, gave two drams two ſcruples and ſix grains of reſinous extract, and afterwards with Water, three drams of Gum; two drams and a ſcruple remaining undiſſolved. Another ounce treated firſt with water, yielded three drams two ſcruples and ſix grains of gummy extract; and afterwards, with rectified ſpirit, one dram of Reſin, the indiſſoluble part amounting to three drams and a ſcruple. Both the diſtilled water and ſpirit are impregnated with the flavour of the Opopanax, but no actual Oil can be ſeparated, at leaſt on diſtilling ſmall quanties of the juice.

XIV. SAGAPENUM. SAGAPENUM is a Gummy-reſin of unknown extraction, both in regard to the plant and the place of its growth. When freſh it appears like the other juices, whitiſh: By age, it becomes yellowiſh, browniſh, dark-coloured. Good Sagapenum looks almoſt like horn; it is tranſparent, browniſh on the outſide, whitiſh within, of a ſomewhat acrid taſte, and a ſtrong diſagreeable ſmell, like that of a mixture of Galbanum, Opopanax and Bdellium, with a little Aſafœdita.

An ounce of the purer ſort, digeſted with rectified Spirit of Wine, yielded five drams and ſix grains of reſinous extract: The remainder boiled with water in a cloſe veſſel, ſo long as it gave out any thing to the menſtruum, yielded five ſcruples and eight grains of Gum, one dram and five grains being left undiſſolved. Another ounce treated firſt with water, gave two drams two ſcruples and a half of gummy extract; and afterwards, with rectified ſpirit, four drams and one grain of Reſin, one dram and ſix grains being left. The diſtilled ſpirit is ſenſibly, and the diſtilled water ſtrongly, impregnated with the flavour of the Sagapenum: Along with the water ariſes a conſiderable portion of actual Oil——This and the preceding Gummy-reſin are employed in medicine, in the ſame caſes as Ammoniacum.

XV. MYRRH.

MYRRH is another Gummy-reſin whoſe origin is wholly unknown. It comes immediately from Alexandria, Smyrna and Aleppo, often in large bales of ſeveral hundred weights, incloſed in leather. It is hard, dry, gloſſy, of various colours, yellowiſh, reddiſh, brown, yellowiſh-brown, reddiſh-brown, blackiſh, intermixed with whitiſh ſpecks or tears, tranſparent like Agate, or opake like Pitch, of a peculiar ſtrong ſmell, and a bitter ſomewhat biting taſte. The beſt is that which is of a reddiſh-brown colour, not verging too much to yellowiſh or blackiſh, uniform on the outſide, internally ſpecked or ſtreaked with white, clear and bright, ſomewhat unctuous to the touch, but not tenacious ſo as to ſtick to the fingers.

This Gummy Reſin is liable to great abuſes, the larger maſſes in particular, are frequently no other than ſome artificial compoſition, ſkilfully incruſtated on the outſide with a ſolution of Myrrh. Some report that Bdellium is nearly allied to Myrrh, and not eaſily to be diſtinguiſhed from it: The differences however are ſufficiently obvious, Bdellium being darker coloured and leſs tranſparent than good Myrrh, internally ſoft and tenacious, which Myrrh never is, yielding a quite different ſmell, and wanting its bitterneſs.

From ſixteen ounces of Myrrh were obtained by means of water, twelve and an half of gummy extract; and from the reſiduum by rectified ſpirit, one and a half of Reſin. On treating the ſame quantity firſt with ſpirit and afterwards with water, I obtained five ounce of reſinous, and eight ounces ſix drams of gummy extract. The indiſſoluble matter amounted in both operations, to two ounces, or one eighth of the Myrrh.

In diſtillation with water, an eſſential Oil ariſes, to the quantity of three drams from a pound. This Oil ſmells and taſtes extremely ſtrong of the Myrrh, and contains all that part in which the peculiar qualities of the juice reſide: It differs remarkably from that of the other Gummy-reſins, in not being hot or pungent, in being ſo ponderous as to ſink in water, and

Myrrh. in not being in the leaſt elevated by Spirit of Wine; highly rectified Spirit, diſtilled from Myrrh receiving no ſenſible impregnation either in ſmell or taſte.

It is further obſervable, that whether we digeſt Myrrh in Water or in Spirit, the whole of its ſmell and taſte is taken up by the menſtruum applied firſt: An extract made by water after ſpirit has performed its office, and by ſpirit after water, are inodorous and inſipid. Both the tincture and the extract made by pure ſpirit at firſt, contain all the active parts of the Myrrh: The watery infuſion or decoction, if made in ſuch a manner as to prevent evaporation, does the ſame; but on exhaling it to the conſiſtence of an extract, all the flavour of the Myrrh is loſt, and nothing but its bitterneſs remains: No one can diſtinguiſh in the watery extract any thing of the ſpecific characters of the Myrrh. From theſe experiments we learn in what manner this juice is to be treated to the beſt advantage, and in what preparations its virtues are preſerved or loſt.

It is obſervable alſo, that on incloſing ſome powdered Myrrh in the white of a hard boiled egg, and ſetting it in a moiſt cellar, the liquor into which the egg is by degrees reſolved, extracts nearly all the ſmell and taſte of the Myrrh; that this liquor, commonly called *Oleum Myrrhæ per deliquium*, is precipitated or coagulated by Spirit of Wine; and that the unctuous coagulum, ſeparated from the ſpirit, diſſolves again in pure water. This proceſs has been applied likewiſe to Maſtich and other pure Reſins; but from thoſe, as I have found upon trial, the white of eggs extracts nothing, the liquamen not being different from that produced by the egg alone.

Phyſicians aſcribe great virtues to Myrrh, and employ it as a balſamic, antiſeptic, attenuant and deobſtruent; for promoting expectoration, perſpiration urine, the menſtrual and hæmorrhoidal diſcharges, and the eruption of the ſmall-pox, &c.

XVI. TERRA JAPONICA, *Catechu*, Japan Earth, Terra Japonica. ſo called from its having been long ſuppoſed by the Europeans to be an earthy ſubſtance found in Japan, TERRA JAPONICA.

is neither one nor the other. It belongs to the Claſs of Gummy-reſins; being ſuch a combination of gummy and reſinous matter, as the extracts made from vegetables by water. In effect it is no other than a preparation of this kind, obtained by inſpiſſating a watery decoction or the expreſſed juice of the fruit of a certain Palm-tree, growing plentifully on the ſea-coaſts in Coromandel, Cambia, Bacaim, Manora, Daman, and ſeveral other parts of the Eaſt-Indies. The fruit, held there as a delicacy, is called *fauſe*, its kernel *areca*, and the leaves of the tree *betel*: Hence the names of the plant, *Palma fauſeliſela*, *arecifera*, &c.

The beſt Japan earth is that prepared by expreſſion, but the greater part of what is brought to us is a true watery extract. There are conſiderable differences in the product according to the manner in which the proceſs has been managed, and the degree of maturity or perfection of the fruit itſelf: That Lime-water, Gum Arabic, Liquorice, Vitriol, or other like ſubſtances are added, is a groundleſs conjecture. Some ſorts are of a pale reddiſh-brown colour, others of a dark blackiſh-brown, or quite black like Bitumen; ſome are ponderous, and others light; ſome compact, and others porous; ſome more and others leſs aſtringent. The beſt ſort is of a dark reddiſh-brown, dry, heavy, hard, compact and gloſſy; chewed, it diſcovers at firſt a bitteriſh ſtyptic taſte, which is followed by an agreeable ſweetneſs.

Japan earth, when pure is almoſt totally diſſolved, its aſtringency at leaſt is totally extracted both by water and ſpirit. Four ounces of the beſt I could procure yielded with water, three ounces and ſix drams of ſolid extract; after which, rectified ſpirit took up no more than twelve grains: The indiſſoluble part conſiſted chiefly of ſand, woody, and other foreign matters. Four ounces of the ſame *Terra Japonica*, treated firſt with rectified ſpirit, gave juſt three ounces of reſinous extract: The reſiduum ſtill yielded with water, five drams two ſcruples and eight grains of a gummy one. Another parcel yielded, on the ſame quantity, two drams more of ſpirituous than of watery extract;

TERRA JAPONICA. tract: But all the ſorts agree in the material points, namely (1.) That the ſpirituous tincture is of a redder colour, brighter, clearer, and more fluid than the watery, the latter appearing browniſh, quite thick, and at laſt curdly. (2.) That the ſpirituous extract inſpiſſated, proves ſtronger, more aſtringent, and more diſagreeable than the watery, the latter poſſeſſing the agreeable ſweetneſs of the *Terra Japonica* itſelf improved rather than injured. (3.) That the extracts made by water after ſpirit, and by ſpirit after water, have no remarkable taſte.

Hence where a ſtrong aſtringent is required, whether for external or internal purpoſes, we are directed to the ſpirituous tincture and extract; and for a milder and more grateful corroborant, to the watery extract. A little of this laſt taken into the mouth at bedtime, and ſuffered ſlowly to diſſolve, proves remarkably ſerviceable in diſorders of the throat.

CLASS IV.

CAMPHOR.

CAMPHOR. THERE are ſundry Indian plants from which CAMPHORS are obtainable, but only two which afford any large quantity, and from which this commodity is commonly prepared, one growing in Sumatra and Borneo, the other in Japan, as particularly about Satſuma. The firſt is called by Breynius *Camphorifera Sumatrana*, &c. the Camphor-tree of Sumatra, with leaves like thoſe of the Clove-tree but longer pointed, a large oblong fruit, and a very large cup ſomewhat reſembling a Tulip: The latter, *Camphorifera Japonica*, &c. the Camphor-tree of Japan, with Bay like leaves, a ſmall globular fruit, and a very ſhort cup. The Camphor of the Japan ſpecies is the only ſort met with in the ſhops, the other being never brought into Europe. This tree is about the ſize of a large Lime, the flowers are white, the fruit is a ſmall red berry. All the parts of it are impregnated with Camphor, but the roots contain moſt:

Hence

Hence the roots are chiefly made uſe of for the preparation of this commodity, though in want of ſufficient quantities of theſe, the wood and leaves are mixed.

Method of obtaining it.

The Camphor is extracted by diſtillation with water in large iron pots, on which are fitted earthen heads ſtuffed with ſtraw; greateſt part of the Camphor concretes amongſt the ſtraw in its cryſtalline form, and a part likewiſe paſſes down into the receiver along with the water. It is ſaid by ſome to be extracted by ſublimation without water; but by ſuch a proceſs, it could not avoid receiving from the woody matter, an empyreumatic ſmell, which it is never found to have. The rough Camphor, as firſt diſtilled, looks much like the grey, ſmall cryſtalled Eaſt-Indian Saltpetre, or like common Bay-ſalt: In this ſtate, it is imported in caniſters, into Europe, particularly into Holland, and there purified or refined.

Refining.

The refining of Camphor was formerly one of the manufactures of Venice, the Venetians being then the only people in Europe, who traded directly to the Eaſt Indies. But that trade has long ago paſſed into other hands: The Venetians now import little or no Camphor, and the art of refining it is known only to the Dutch. The Engliſh and French import ſome rough Camphor, but ſend it to Amſterdam to be refined, having never been able to ſucceed in the proceſs themſelves. I have been in one of the largeſt refineries, in which there was fifty furnaces, all managed by women; and have ſeen the whole operation after the matter had been put into the veſſels, but no one is permitted to ſee it before. The purification is effected by ſublimation, but doubtleſs ſome additional matter is made uſe of for keeping down the impurities of the Camphor (*r*). The ſublimation is

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(*r*) *Refining of Camphor.*] Camphor may be refined by ſublimation without any additional matter. The principal point is the regulation of the fire; which ſhould be juſt ſtrong enough to keep the Camphor ſubliming, and make the upper part of the glaſs ſo warm as that the ſublimate may bake together into a cake. There is a good deal of nicety in hitting this point; and upon the whole, the method pointed out in the following note ſeems to be more commodious.

CAMPHOR. is performed in low flat-bottomed glaſſes placed in ſand: The Camphor concretes, in the upper part of the belly of the glaſs into a ſolid cake, which, after the veſſel has been broke, is pared with a knife, and is now the refined Camphor of the ſhops. Gronovius has given a good account of the method of managing the ſublimation.

Its general properties. Pure Camphor is a dry, colourleſs, tranſparent maſs, in appearance reſembling a Salt, ſo light as to ſwim on water, moderately compact, yet eaſy to break, though not reducible by itſelf into fine powder, ſoft, and as it were ſaponaceous to the touch when rubbed betwixt the fingers, of a ſtrong penetrating ſmell, and an acrid aromatic taſte, very eaſily inflammable, and ſo volatile as to exhale totally in a warm air. From theſe properties, it is obvious that Camphor cannot be adulterated, much leſs counterfeited, as ſome ridiculouſly pretend, with Tallow, Maſtich, and Spirit of Wine. In order to preſerve this volatile concrete from any loſs in keeping, the ancients covered it with certain ſeeds, doubtleſs with a view to the more effectual excluding of the air: Some have been hence miſled into an abſurd conceit, that the ſeeds poſſeſſed ſome peculiar power of fixing the Camphor; and it is at this time no uncommon practice to put up a few Linſeeds, Pepper corns, *&c.* along with it. The only method of preſerving Camphor is, to keep it in a cool place ſecured from the air: If tied in papers or bladders, then put into leaden or tin caniſters, or glaſs or earthen veſſels, and ſet in a cool cellar, we need not be afraid of loſing a ſingle grain in many years. I have kept Camphor tied in an ox's bladder, in the heat of boiling water, for an hour, without being able to perceive any ſmell ariſing from it during the coction, or any diminution in its weight.

Uſe in medicine. Camphor, conſidered as a medicine, is a very warm diaphoretic, and antiſeptic: It does not however heat the conſtitution ſo much as might be expected from its hot pungent taſte. I have been aſſured by an eminent phyſician, that a ſingle drop of Oil of Cinnamon, CAMPHOR.

Cinnamon, though generally containing a little expreſſive Oil, heats more than ten grains of Camphor; and an ounce of ſtrong Spirit of Wine, more than a whole dram——Camphor is employed likewiſe in fire-works, and in ſundry other arts, particularly for varniſhes. Camphorated varniſhes excellently preſerve both animal and vegetable bodies, and peculiarly reſiſt worms and other inſects. Camphor in ſubſtance alſo laid among clothes, preſerves them from moths.

In varniſhes &c.

Solution in different menſtrua.

Camphor diſſolves eaſily and plentifully in vinous ſpirits, and in oils: Four ounces of rectified ſpirit will diſſolve three of Camphor. When thus diſſolved, we need not fear that any part of it will be diſſipated in a warm air at leaſt till all the ſpirit has exhaled firſt, for if the ſolution be committed to diſtillation the ſpirit will all diſtil before any of the Camphor begins to ariſe (*s*), and even if ſet on fire, the ſpirit will firſt burn away, the Camphor remaining untouched till the ſpirit is all conſumed, and then burning by itſelf with a quite different, ſmoky, ſooty flame. Among the mineral acids, the nitrous diſſolves it moſt eaſily and in largeſt quantity: One part of Camphor diſſolves readily in two of Spirit of Nitre, but requires three of Oil of Vitriol, with the aſſiſtance of digeſtion: The diluted vitriolic acid does not diſſolve it at all; and the marine acts ſo languidly, that it may be doubted whether this acid diſſolves it any otherwiſe than by virtue of a portion of nitrous acid intermixed. Vinegar and other mild vegetable acids, and alcaline liquors have no effect on it.

The nitrous and vitriolic ſolutions afford ſome very diſſimilar phænomena: The Camphor abſorbs the more concentrated part of the nitrous ſpirit, and forms with it a fluid like Oil, which floats on the ſurface: With the vitriolic acid it unites equably into

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(*s*) *Diſſolved in ſpirit—the ſpirit diſtils firſt.*] This property affords an effectual and commodious method of purifying Camphor. By diſſolving rough Camphor in rectified Spirit of Wine, its impurities are ſeparated: The ſpirit is recovered by diſtillation; and the remaining Camphor may afterwards be melted into a cake in the bottom of the veſſel, or of another glaſs. The cake eaſily parts from the glaſs upon warming it a little.

one

CAM-PHOR.

one uniform liquor. To the nitrous acid it ſcarcely gives any tinge, the Oil being but juſt ſenſibly yellowiſh, whilſt the ſolution in the vitriolic acid is at firſt conſiderably coloured, and on ſtanding becomes more and more ſo, changing at laſt to a quite dark reddiſh-brown. The vitriolic acid, if its quantity is large, deſtroys the ſmell of the Camphor, which is not eaſily concealed by any other menſtruum. If water be mixed with the ſolutions made either in Spirit of Wine or in acids, the Camphor inſtantly ſeparates, and reſumes its original appearance and qualities. The addition of Silver or Quickſilver to the nitrous ſolution produces a like effect, the acid letting the Camphor go, and attacking the metal. It is obſervable that no heat or effervescence ariſe during the diſſolution of Camphor in the nitrous acid, which raiſes ſo violent a heat and ebullition with eſſential Oils.

Preparations.

The principal preparations of Camphor are, camphorated Spirit of Wine, and an Oil of Camphor. The camphorated ſpirit is no other than a ſolution of Camphor in rectified ſpirit. Some have thought to unite the Camphor and ſpirit more intimately together by diſtillation; but that proceſs, inſtead of uniting, ſeparates them. Hoffman and Rothe direct Salt of Tartar to be added previous to the diſtillation, and promiſe, by this method, a camphorated ſpirit, which will mingle with water, without any ſeparation of the Camphor. This indeed the ſpirit will do, for there is ſcarcely any Camphor in it: It is in ſome degree impregnated with the ſmell of that ſtrong-ſcented concrete, but the quantity of actual Camphor that ariſes with it does not amount to above two grains in a quart: No wonder that with ſo ſmall a proportion there ſhould be no ſenſible milkineſs or precipitation.

Oils of Camphor.

There are ſundry Oils of Camphor prepared by diſtillation. One is made by diſtilling Camphor from red Bole or other loamy earths, and repeating the diſtillation from a freſh parcel of the earth, till the whole of the Camphor is changed into an Oil: This Oil has by ſome been greatly eſteemed, as no

Camphor ſeparates from it on the admixture of water, I tried the proceſs with half an ounce of Camphor, and two ounces of powdered red Bole, mixing them well together, and urging them with a gradual fire in a retort: The Camphor aroſe much ſofter than at firſt, and in ſome meaſure unctuous, and on diſtilling it over a ſecond time from the ſame quantity of Bole, about one half of it became fluid. Both the liqour and the ſublimate being mixed with two ounces more of Bole, and the diſtillation repeated, the whole of the Camphor aroſe in the form of a fluid Oil, with a little water, weighing together about an ounce. A part of the inflammable principle of the Camphore appeared to be retained each time by the ferrugineous matter of the Bole, all the reſidua being conſiderably black and ſparkling.

CAMPHOR.

Another Oil of Camphor is prepared by digeſting one part of Camphor with four parts of Oil of Turpentine, and then diſtilling them. Lemery relates, that Camphor and Oil of Turpentine are of the ſame degree and volatility, and that they both diſtil perfectly together. I repeated the diſtillation in freſh retorts ſix times ſucceſſively, but always found a part of the Camphor ſublimed by itſelf: There was alſo another more remarkable ſeparation: a portion of theſe ſubtile volatile bodies remaining every time at the bottom of the retort, and proving ſo fixed as to bear a red heat.

A third Oil of Camphor is made from Camphor and Venice Soap, by diſtillation and cohobation, in the ſame manner as the two foregoing: This is called by ſome *Oleum camphoræ arthriticum.* All the three have ſomewhat of an empyreumatic odour; and conſidered as medicines, are of little or no conſequence. Camphore is one of thoſe drugs which art cannot improve either for medicinal or mechanic uſes; and which are therefore to be given in their entire ſubſtance, or unchanged in their compoſition. All the aſſiſtance that the phyſician can in this caſe expect from the chemiſt, is, to diſcover the moſt commodious means of fitting the ſubject for exhibition.

For

CAMPHOR. Fitted for medicinal exhibition.

For reducing Camphor into powder, and thus fitting it for ſuch forms as receive powdery ingredients, it ſhould be moiſtened with a few drops of rectified Spirit of Wine, which will render it eaſily pulverable. Some endeavour to impregnate water with Camphor, by ſetting the Camphor on fire and quenching it with water, but this is both an unfrugal and an ineffectual method. The beſt way of obtaining a watery ſolution of Camphor is, to grind it with Almonds, in the proportion of about four ſcruples of Almonds to half a dram of Camphor: By this means the whole of the Camphor will be rendered ſoluble in water into the form of an emulſion. By agitating and grinding it with the yolk of an egg [or with mucilages] it becomes likewiſe miſcible with water: The yolk of one egg is ſufficient for about two ſcruples of Camphor. Sugar, the common intermedium betwixt oily or reſinous bodies and water, anſwers leſs effectually for Camphor, and lets it go much ſooner on the admixture of watery liquors, than either Almonds or yolk of Eggs.

CLASS V.

GROSS OILS.

OILS. Oil Olive.

THESE kinds of Oils are always artificially extracted by expreſſion or by coction in water. OIL OLIVE is obtained from the fruit of the *Olea Sylveſtris* or wild Olive-tree, of which there are large plantations and entire foreſts in Spain, Portugal, Italy, and other warm countries. The pickled Olives are the green unripe fruit: The Oil is prepared from ſuch as is ripe, in which ſtate it appears of a blue colour and about the ſize of the ſmaller kinds of plums. It ripens in November and December. The ripe Olives are kept under cover for ten or twelve days, till they begin to grow hot, then ground betwixt two hard ſtones, in the ſame manner as the ingredients for gun-powder, and afterwards preſſed in baſkets made for that uſe. The Oil which runs

runs out firſt, with very little preſſure, is called Virgin Oil, and in effect is the beſt. After the ſeparation of this, the matter is mixed with a large quantity of hot water, the liquor ſtrained off and ſtrongly preſſed out, and this proceſs repeated in ſome places two or three times: The Oil ariſes to the ſurface of the water, and is thence eaſily ſcummed off. Some repeat the grinding, as well as the expreſſion with water, and thus obtains Oils inferior in goodneſs. The beſt Oil Olive is that of Genoa; but the greateſt quantities come from Spain, particularly from Seville.

OILS.

OIL OF BEN is obtained from the Ben nut, (*Balanus myrepſica, glans unguentaria*) by ſimple expreſſion, nearly in the ſame manner as the Oil of Almonds is commonly extracted.

OIL of BEN, &c.

Oils are expreſſed alſo from different ſubſtances, among ourſelves, for mechanic uſes; as from Nuts, Linſeeds, Rape-ſeed, Hempſeed, &c. and divers machines have been contrived both for grinding and preſſing the ſubject.

THESE Oils are frequently employed as menſtrua for the virtues of vegetable and certain animal ſubſtances. They readily unite with eſſential Oils, diſſolve Reſins, and by the aſſiſtance of heat, extract thoſe principles from ſuch plants as contain them: The ſubject is commonly boiled in the Oil, till the watery moiſture is diſſipated, which is known from a little of the Oil, when ſet on fire, burning away quietly without ſputtering. But though theſe Oils excellently diſſolve the active parts of many plants, the proceſs is accompanied with one great inconvenience, that all the expreſſed Oils require a ſtrong fire to make them boil, far ſtronger than water does, by which the Oil itſelf receives an ungrateful impreſſion, and the diſtinguiſhing flavour of the ſubject is wholly diſſipated. If we boil an aromatic plant in Oil Olive, we ſhall perceive its ſmell ſtrongly diffuſed through the whole houſe, little or nothing of it being left in the Oil. When theſe kinds of preparations therefore are wanted, they ſhould be made by infuſion

MEDICATED OILS.

with a gentle warmth, or by adding to Oil Olive ſuitable quantity of the eſſential Oil of the plant.

PERFUMED OILS.

THE more tender odoriferous flowers, which yield little or no eſſential Oil in diſtillation, as Jaſmine flowers, Violets, Tuberoſes, Hyacinths, Lilies of the Valley, Roſes, Jonquils, Clove July-flowers, and many others, give out their fragrance to expreſſed Oils with little or no heat: The Oils diſtinguiſhed by the name of thoſe flowers, and uſed as perfumes, are no other than expreſſed Oils impregnated with their ſcent. Theſe preparations are made in Spain, Portugal, and more particularly in Italy; on account of the greater fragrance of the flowers in thoſe warm climates, and the greater plenty of Oil of Ben, which is far preferable for this uſe to other Oils, as it does not grow rancid in keeping, or at leaſt not till it has ſtood for a number of years.

The general method of preparing them is this. Some fine carded Cotton is dipt in the Oil, and laid in the bottom of a proper veſſel: On this is ſpread a pretty thick layer of the freſh flowers, above theſe ſome more of the dipt Cotten, and thus alternately till the veſſel is full. The whole is then digeſted for a day and night in the heat of a water-bath; after which the flowers are taken out, the Cotton ſtratified in the ſame manner with freſh flowers, and the proceſs repeated till the Oil ſqueezed out from the Cotton, is found to be ſufficiently impregnated with the odour of the ſubject. The digeſting veſſel is either of Tin, with a cover to ſcrue upon it, or of Porcelane, compoſed of two parts, which are cloſely luted together: Moſt of them have an air hole in the top, which is ſtopt with a doſſil of the oiled Cotten, which retains ſuch of the odorous effluvia as would otherwiſe make their eſcape. Some, inſtead of the Oil of Ben, take the Ben-nut itſelf, cut it in pieces, ſtratify it repeatedly with the flowers, and then preſs out its Oil; but the Oil thus obtained is greatly inferior in fragrance to the other.

OIL of BAYS.

THE OIL OF BAYS, *Oleum laurinum*, is prepared by coction, in Italy, Spain, Portugal, and oth

Oil of Bays. warm climates. Freſh Bay-berries, thoroughly pounded, are boiled in water for a conſiderable time; and the fire being then removed, the decoction, after its groſſer parts have ſubſided, laded out of the caldron. When grown cold, the Oil is found ſwimming on its ſurface, of a thick conſiſtence like Butter. The remaining berries are further pounded, preſſed, again boiled in water, and this proceſs ſeveral times repeated. Some keep the ſeveral Oils apart; others make only one ſort, mixing them altogether.

Palm Oil. PALM OIL, *Oleum palmæ*, is prepared in the ſame manner. from a fruit about the ſize of a hen's egg, called *aouara*. The tree which produces it reſembles a Palm-tree, and grows in Africa on the Senega river; whence the Oil is called by moſt of the French writers, *Huile de Senega*; by ſome it is named *Huile de Pumicin*. This Oil when freſh, has an agreeable ſmell, and is uſed by the Africans in food, as Butter among us. By age, it becomes firm and hard like Tallow.

Oleum Cacao. THE OLEUM CACAO, uſed chiefly in pomatums, is obtained alſo by coction and expreſſion, from the Cacao or Chocolate nut, called by the Indians *Cacahuatl*.

Oleum de Kerva. THE OLEUM DE KERVA, *Oleum kikinum*, or *Oleum ficus infernalis*, is extracted in the ſame manner from the fruit of the *Ricinus*, called *Grana tiglia*.

CLASS VI.

SWEET SALINE JUICES.

I. Manna. MANNA, ſo called from its having been long ſuppoſed to deſcend in dew from heaven, like that with which the Iſraelites were fed in the wilderneſs, has been inconteſtably proved to be the proper native juice of the tree upon which it is found. The tree covered with clothes, a branch cut off and carried into a cellar, have continued to bleed Manna as freely as when expoſed to the open air and dew.

MANNA.

From different vegetables.

In Perſia and Syria, a ſpecies of Manna exudes in hot weather, from a prickly ſhrub, called by Tournefort *Albagi maurorum rauwolfii*; by Caſpar Bauhine *Geniſta-ſpartium ſpinoſum foliis polygoni*. This is ſaid to be leſs purgative than ours, and not to keep above a year, whereas ours, if preſerved in a proper place, continues good for at leaſt five years.

Dr. Grim and Dr. Helbig, in the *Ephemerides naturæ curioſorum ann.* I. give an account of a ſubſtance in appearance, conſiſtence and taſte, reſembling Manna, found upon certain trees in Ceylon and the Eaſt Indies: But as this ſubſtance is ſaid to be prepared by inſects, it may perhaps be more properly looked upon as a concrete Honey than a Manna.

In Dauphiny, Provence, and ſome others of the ſouthern parts of Europe, a Manna exudes from the Turpentine and Larch-trees, but in ſmall quantity and not eaſily to be collected pure.

Different kinds of the Manna of the Aſh tree.

The common Manna of the ſhops is the produce of a ſpecies of the Aſh-tree, *Fraxinus rotundiore folio, C. B.* growing in Naples and Sicily, particularly in the Province of Calabria. The juice exudes ſpontaneouſly, in hot dry weather of June and July, upon the leaves, the branches, and the trunk of the tree; that collected from the leaves is called *Manna di fronda*, from the branches *Manna di ramo*, and from the trunk *Manna di corpo*: This diſtinction is of little importance, as the juice is always the ſame whatever part of the plant it iſſues from, as much ſo, as the blood drawn from different parts of an animal body. Theſe ſpontaneous exudations are the fineſt, whiteſt, and pureſt Manna, being naturally filtered and ſecreted from the groſſer parts: But if there was no other, Manna would be rare. When nothing more will exude, the bark is wounded with knives; upon which the juice iſſues more copiouſly, but of a yellowiſh colour, and a groſſer and thicker conſiſtence. In dry weather the Manna ſoon concretes, and is then ſcraped off, to make room for the juice that is to follow. The Manna thus collected is called *Manna ſforzata*, or forced Manna. As watery moiſture would be of-

ten

MANNA.

it to ferment, and turn ſour or mouldy; it is further exſiccated by the ſun's heat, or in a warm room; but ſufficient care is taken not to diminiſh its weight too much by making it thoroughly dry.

Thoſe who purchaſe this commodity at the firſt hand, divide it into four ſorts; *Manna granata*, or Manna in ſmall grains; *Manna maſtichina*, or Manna in larger grains like Maſtich; *Manna canellata*, or *electa*, or ſuch as is in fine, pure, long pieces; and *Manna commune*, or the ordinary foul Manna. In the ſhops, only the two laſt are diſtinguiſhed.

Deſcription of the beſt ſort.

Fine Manna is in oblong, roundiſh, ſingle pieces, moderately dry; of a whitiſh or pale yellowiſh colour, internally compoſed as it were of fine capillary cryſtals, a proof that the juice has been exſiccated by a very gentle warmth. The ordinary kind is of a darker yellowiſh colour, inclining to brown, mixed with particles of wood leaves and other impurities, in irregular lumps, generally moiſt. The whiteneſs, dryneſs, lightneſs, purity, chryſtalline appearance upon breaking, and ſweet taſte, are the beſt marks of the goodneſs of Manna.

Sophiſtications.

Manna is often counterfeited or ſophiſticated with other ſubſtances, particularly Sugar and Starch. Theſe may be diſcovered by diſſolving the maſs in water, and inſpiſſating the ſolution, when the adulterated ſorts will turn out far more clammy and tenacious than the genuine, and quite different from it in appearance. Sugar may likewiſe be diſtinguiſhed in good meaſure by cryſtallization: If the ſtrained ſolution be evaporated to the conſiſtence of a thick ſyrup, and then ſet in a cloſe warm place, a part of the Sugar will generally concrete into Candy. There are ſome ſorts of Sugar however, which do not eaſily ſeparate in this proceſs from the Manna, but remain permanently united with it. The ſingular phænomena which I have diſcovered in treating this concrete with Spirit of Wine, afford more commodious and more certain criteria of its genuineneſs.

Purification by Spirit of Wine.

Manna, dried a little, diſſolves in rectified Spirit of Wine. The filtered ſolution ſet in a gentle digeſting heat,

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heat, throws off near five-eighths of the original quantity of the Manna, all over the bottom and ſides of the glaſs: The part thus ſeparated, is as it were the quinteſſence of the Manna: It is of a fine white colour, light, ſpongy, in ſome degree cryſtalline: It inſtantly melts upon the tongue, like ſnow in warm water, and impreſſes an agreeable ſweet taſte, without any thing of the ungrateful reliſh obſerved in the Manna at firſt. If the remaining liquor be gently exhaled a little, and at times ſet by again, there precipitates about one fourth the quantity of Manna employed: This reſembles in appearance ordinary Manna, but taſtes more agreeably, and diſſolves pretty readily in the mouth, though not near ſo much as the foregoing. On ſtill further evaporating the liquor, we obtain a thick extract, of the conſiſtence of a Balſam, which can ſcarce be fully exſiccated, but continues moiſt, and greatly reſembles in appearance Civet grown brown by age: In this extract, whoſe quantity is about one eighth, reſides all the nauſeous matter of the Manna: It has indeed a degree of ſweetiſh taſte, but blended with a diſguſtful one.

Treated with water.

On diſſolving Manna in water, and ſlowly exhaling the ſolution, no ſeparation is made: The whole quantity of the Manna is recovered, unchanged except that the colour proves ſomewhat darker.

By diſtillation.

In diſtillation, Spirit brings over nothing: The diſtilled water taſtes ſomewhat differently from pure water, but does not appear to poſſeſs the purgative quality which ſome have aſcribed to it, though it is certain that Manna loſes of its cathartic virtue by much boiling. Some report, that water diſtilled from a mixture of Manna with twice its weight of Nitre, taſtes like Bitter Almonds, and have given to the liquor the name of *Manna meteorizata*. I have repeated the experiment with great care, but could not perceive the leaſt degree of any ſuch taſte in the diſtilled water.

By deſtructive diſtillation in a ſtrong fire, a pound of Manna yielded twelve ounces two drams of a phlegmatic liquor impregnated with acid and with a fetid

MANNA.

Oil; as alſo two drams and a ſcruple of an empyreumatic Oil diſtinct or in its proper form: The remaining coal weighed three ounces and one dram. The acid ſpirit has been ſaid to diſſolve Gold: This preſumption probably proceeded from theſe philoſophers, who imagined a certain aereal ſpirit to be the radical menſtruum of Gold, and Manna to be an aereal production largely impregnated with that ſpirit: The acid ſpirit of Manna, however concentrated, has no action on Gold, nor any other powers different from thoſe of the common acetous acid.

By fermentation.

Lemery has given ſome experiments on Manna in the French Memoirs for the year 1708: He obſerves that when fermented with water, it yields a weaker and leſs agreeable liquor than the Mead made with Honey; that two pounds of Manna yielded, after fermentation, eight ounces of a weak vinous ſpirit, which afforded only one ounce and a half of rectified ſpirit; that the reſiduum, ſet by to ſour in a warm place, for a year and a half, gave ſeven drams of an eſſential Salt, which was white, hard, brittle, and cryſtallized into the form of needles. This Salt is to be looked upon as of the Tartar kind; not as being extracted, but produced, from the Manna.

Its medical uſes.

Manna appears upon the whole to be a juice of the ſame nature with Honey and Sugar; being like them ſweet, inflammable, ſoluble in Water and in Spirit, fermentable ſo as to yield a vinous liquor and ſpirit, a Vinegar and Tartar, *&c.* It poſſeſſes alſo, like them, a laxative quality, but in a greater degree.

Manna is one of the mildeſt and ſafeſt purgatives, for children and weak perſons, in coughs and obſtructions of the breaſt, where mineral Waters do not freely paſs, in caſes where the ſtronger cathartics cannot be borne. It has one inconvenience, being apt to occaſion flatulencies and ſlight gripes. This may be remedied by carminative additions.

II.
SUGAR.

SUGAR is the eſſential Salt of a ſpecies of Reed or Cane (*Arundo ſaccharifera C. B.*) growing ſpontaneouſly in Africa and Aſia, and cultivated in large

SUGAR.

quantities in the Engliſh, French, and other European ſettlements in the warmer parts of America, where all our Sugar is prepared. A kind of Sugar is obtained likewiſe in the Eaſt Indies from certain trees and other vegetables; and ſome of our own plants alſo afford a ſaccharine concrete (r).

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(r) *Sugar from certain trees, &c.*] In ſome parts of North America, particularly in Canada, a kind of Sugar is prepared from the juice which iſſues upon wounding or boring certain ſpecies of the Maple-tree, one of which is named from hence the Sugar-maple; as alſo from the wild or black Birch, the Honey-locuſt, and the Hickery. The Maple is moſt commonly made uſe of for this purpoſe, as being the richeſt, and as beſt enduring the long and ſevere winters of that climate. The juice is boiled down, without any addition, to a thick conſiſtence, then taken off from the fire, kept ſtirring till its heat is abated, and ſet it in a cold place; where the Sugar quickly concretes into grains, reſembling common brown powder Sugar.

The trees are tapped early in the ſpring, about the time that the Snow begins to melt: It is obſervable, that when the weather begins to grow warm, they bleed no more; and that after the bleeding has ſtopt, they begin to run again upon covering the roots with ſnow. The more ſevere the winter has been, the juice is found to be richer and in greater quantity. The trees which grow on hills or high land yield a richer juice than thoſe which are produced in low countries; and the middle aged than the young or the old.

Mr. Kalm informs us, in the Swediſh tranſactions for the year 1751, that one tree, if the ſummer does not come on haſtily, will yield about forty-two gallons of juice, (Engliſh Wine-meaſure,) and that the quantity which iſſues in one day is from three to ſix gallons: That eleven gallons of juice of middling quality give a pound of Sugar, and that ſometimes a pound has been gained from three gallons and a half: That two perſons can in one ſpring prepare commodiouſly two hundred pounds. He obſerves that this Sugar is weaker than that from the Sugar-cane, but that for ſome purpoſes it anſwers better, as for Chocolate and Preſerves. It is likewiſe eſteemed more medicinal: Conſiderable quantities are brought annually into Europe, particularly France, and there employed in diſorders of the breaſt. It is reckoned that a pound of common Sugar goes as far in ſweetening as two pounds of Maple Sugar.

The large Maple, commonly called Sycamore-tree, bleeds alſo in Europe a ſweet juice, from which an actual Sugar has been prepared. In the Tranſactions above mentioned, for the year 1754, there is an account of ſome experiments made in this view upon the Swediſh Maple. Eight trees, none of them under thirty years, bled, in four days, fourteen gallons of juice, which inſpiſſated gave two pounds and a half of brown Sugar. Another time, the ſame eight trees bled, in three days, ten gallons and a half, which yielded one pound four ounces of Sugar, with half a pound of Syrup. It is the Saccharine juice of the Maple-tree, which, exuding upon the leaves, renders them ſo apt to be preyed upon by inſects.

The common Birch bleeds alſo a large quantity of a ſweetiſh juice, which yields on being inſpiſſated a ſweet ſaline concrete, not however

perfect

SUGAR. History of its preparation.

The Sugar-cane ariſes to the height of five or ſix feet: It has long leaves, ſharp at both ends; and produces in the middle a kind of arrow, bearing ſilver white flowers: It ſends out ſuckers from the roots, by which the plant is propagated. When the Cane is ripe, it is cut down, cleared from the leaves, and its ſweet juice forced out by paſſing betwixt wooden rollers: In one mill there are commonly three rollers, placed perpendicularly, and turned by Water, by wind, or by cattle. The juice is conveyed from the mill, along a trough or ſpout into the boiling-houſe, either immediately into the boiler, or into a reſervoir: It will ſcarcely keep above a night, without fermenting, and turning ſour, or producing a portion of inflammable ſpirit, ſo as to be apt to take fire in the boiling, and endanger the whole building: Hence the neceſſity of boiling it down into Sugar as faſt as it is preſſed out from the Cane.

This juice contains a large quantity of impurities, conſiſting partly of a groſs unctuous and herbaceous matter, ſeparable by colature, and by deſpumation during the boiling; and partly of an oily ſubſtance more intimately blended, ſo as to require for its ſeparation certain additions, as alcaline ley, and more particularly Lime-water: Without theſe additions, it never aſſumes the form of a concrete Salt or Sugar, yieding only a ſoft unctuous extract, which cannot be reduced to perfect dryneſs without ſuch a degree of fire as renders it fetid and empyreumatic. After the firſt boiling and deſpumation, the juice is emptied into other coppers, a quantity of a ley, made from wood-aſhes or from aſhes and Quicklime, added to it, and the coction and clarification continued. When, towards the end of the inſpiſſa-

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perfectly of the Saccharine kind, but ſeeming to approach more to the nature of Manna.

There are ſundry other vegetables, raiſed in our own country, which afford Saccharine concretes; as Beet-roots, Skirrets, Parſneps, Potatoes, Celeri, red Cabbage-ſtalks, the young ſhoots of Indian wheat. The Sugar is moſt readily obtained from theſe, by making a tincture of the ſubject in rectified Spirit of Wine; which when ſaturated by heat will depoſite the Sugar upon ſtanding in the cold.

SUGAR.

tion, it riſes up, ſo as to be ready to run over the veſſel, the addition of a little oil occaſions it quickly to ſubſide again: It is obſervable, that if Oil, or Citron juice, were added in the firſt boiler, the Sugar would never concrete or part from its impurities. The Sugar, thus obtained, is far from being pure: It is the common brown Muſcovado. This is further refined by diſſolving it afreſh, boiling with Lime-water and ley, and clarifying with oxes blood (*s*): The Sugar-refiners at Orleans in France and in England uſe whites of eggs for the clarification, particularly in making the fine Sugar. By repetitions of this proceſs, the Sugar becomes purer, whiter, of a cryſtalline appearance, but proportionably leſs ſweet. A ſyrupy matter ſeparates in the purification, called from its honey-like conſiſtence Melaſſes or Melazzo: From this are produced, by fermentation, the common inflammable ſpirits, diſtinguiſhed by the name of Melaſſes Spirits. In America, the ſcummings alſo, and other refuſe parts of the juice, are fermented for vinous liquors and Rum.

Chemical properties.

Sugar appears to be a ſalt of the acid kind, ſaturated with earthy and oily matter, on which its ſweetneſs

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(*s*) *Refining of Sugar.*] The author has here overlooked an eſſential part of the proceſs. The Sugar, diſſolved in Lime-water, clarified, and boiled down to a due conſiſtence, is poured into a conical earthen mould, having a ſmall aperture in its lower narrow part ſtopped with a plug. When the Sugar has concreted into a maſs, the liquid part is drained off by the aperture; and ſome fine Clay, ſoftened with Water into a paſte or batter, is ſpread upon the upper broad ſurface: The moiſture of the Clay, ſlowly imbibed by, and percolating through the Sugar carries down with it great part of the remains of the treacly matter. The clayed Sugars, brought from America, are made from the juice directly, without a ſecond ſolution; the liquor being more carefully depurated in the boiling, than when intended for brown Sugar.

Sugar candy is a cryſtallization of Sugar; prepared either from the brown or the white. The perfect cryſtallization of Sugar is not to be effected, like that of many other Salts, by evaporating the liquor in which it is diſſolved, till a pellicle forms on the ſurface, and then ſetting it in a cold place; but by boiling down the ſolution till it is almoſt thick before it is removed from the fire, and afterwards continuing a conſiderable heat, till the cryſtallization is completed. The Sugar is diſſolved in Lime-water, and when evaporated to a proper conſiſtence, poured immediately into pans, in a ſtove or hot room, whoſe air is ſo hot as not to be ſupported by animals for any conſiderable time: The cryſtals concrete upon ſmall ſticks, which are placed acroſs in the pans for that purpoſe.

Sugar.

depends; hence the dimunition of its ſweetneſs in proportion to its purification or the ſeparation of the Oil. Diſtilled by a gradual fire, without addition, it yields, on the pound, about ſix ounces of acid ſpirit, and two ſcruples and a half, or a dram, of empyreumatic Oil. Gently roaſted, it acquires a reddiſh brown colour, and in this ſtate, is uſed for colouring vinous and ſpirituous liquors yellow. By fermentation it yields an excellent kind of Wine; and by a continuance of the proceſs, Vinegar.

With regard to mixture with different ſolutions and other liquors, it is perfectly neutral; making no alteration in thoſe which by acids or by alcalies would be precipitated or have their colour changed. It renders eſſential Oils, Balſams, Reſins, miſcible with watery liquors: Hoffmann obſerves that when added to milk, it prevents the ſeparation of its oily or butyraceous part. From this property he ſuppoſes the dietetic uſe of Sugar to be fattening, as it renders the unctuous or fat parts of the food to be miſcible with the animal juices: I have known however many people, who uſed Sugar in abundance, and yet were lean. It diſſolves in rectified Spirit of Wine; and by the aſſiſtance of heat; but is ſcarcely acted upon by that menſtruum in the cold (*t*).

Many of the Indians employ Sugar inſtead of Salt for preſerving proviſions, which it does effectually, without communicating the unſalutary qualities of ſalted meats: The ſugar may be waſhed out, inſpiſſated, and uſed for the ſame purpoſes again. From this property it has been employed by ſurgeons, as a balſamic and vulnerary.

(*t*) *Solubility in Spirit.*] Rectified Spirit of Wine diſſolves, by a boiling heat, about one twelfth its weight of fine Sugar: if the Solution be ſuffered to ſtand for a few days in the cold, the Sugar gradually ſeparates, into elegant cryſtals. On this principle depends the method of extracting Sugar from ſweet Vegetables by means of Spirit of Wine: Water diſſolves the ſaccharine parts of the ſubject more readily and more copiouſly than ſpirit does, but it keeps them permanently diſſolved, and intermixed with the gummy or other matter which it had extracted at the ſame time; whereas pure ſpirit depoſites the Sugar, and keeps the reſinous or oily principles diſſolved.

CLASS VII.

Juices collected from Vegetable Subſtances by Animals.

I. HONEY.

Honey.

THE HONEY and Wax, gathered by the Bee, are truly vegetable Juices. Honey is collected from the bottoms of flowers, many of which diſcover a conſiderable ſweetneſs to the taſte. Among the flowers which yield the moſt, are thoſe of Thyme, Roſemary, Lavendar, Cowſlips, Primroſes, Marjoram; Baſil; Violets; Roſes, Clove July-flowers, Sage, Balm, Betony, Lilies, the dead Nettle, Sloe-buſh, &c. Bees are uncommonly fond of the Lime-tree, the Privet and Phillyrea. In Lithuania, there are large quantities of wild bees, who lodge in hollow trees in woods, and collect their Honey chiefly from the Lime: Hence, when the ſeaſon happens to be unfavourable at the time of the blowing of the Lime, a ſcarcity of Honey follows. Bees love agreeable ſmells; and are offended by fetids, as Feverfew, Garlic, Onions, Tobacco, &c. They love green and yellow colours, and are offended by black and red.

Whether different in different flowers.

The ancients judged of the goodneſs of Honey from the flowers which the bees had to collect it from: That of Lilies and Roſes was eſteemed the beſt. At preſent, the Honey of Narbonne in France is held to excell all others on account of the Roſemary which there abounds. It is not to be ſuppoſed, however that the Bee confines itſelf to one particular flower: Nor does it appear, that the Honey collected from one kind of flower differs eſſentially from that which is the produce of another; the only difference being in the quantity, colour, or ſome ſlight flavour from the flower. I have ſeen excellent Honey produced where nothing grew but nettles and other weeds.

Its different ſorts.

We meet with Honey of different degrees of conſiſtency and colour; fluid and ſtiff; dark brown, dark yellow, gold yellow, pale yellowiſh and white. The

HONEY.

beſt is that which is of a yellow or pale colour, clear and tranſparent, neither quite ſtiff nor quite fluid, eaſily and totally ſoluble in cold Water, of an agreeable ſmell, and a pure ſweet taſte; ſuch as betrays any particular flavour, does not eaſily diſſolve, or depoſites any ſediment, we may ſuſpect of ſome foreign admixture. Some think to improve their Honey, by communicating by art what the Honey of Narbonne is imagined to receive from nature, a Roſemary flavour. Others dilute thick Honey with Water, and mix meal with the thin. The browniſh and dark brown are generally very impure. The whitiſh, and the granulated, or that which diſcovers, cryſtalline particles, more ſlow of ſolution than the reſt, are not to be rejected: They are both good kinds of Honey, provided they are pure from other admixtures—The manner in which the Honey is extracted from the comb occaſions ſome differences in its quality. That which iſſues ſpontaneouſly upon cutting the combs and thus laying open the cells, is the beſt: Such as is forced out by preſſure is of an inferior kind; and the worſt of all is that extracted by Water: The two laſt contain much of the waxy and other matter of the comb. The Honey gathered by young bees, in the firſt year, and ſeparated from the combs without heat or preſſure, is that properly called Virgin Honey: In the ſhops, the finer ſorts in general are diſtinguiſhed by this name.

Its uſes and chemical examinations.

Honey was the earlieſt ſweet employed for medicinal or domeſtic uſes; the art of preparing Sugar being but of late diſcovery. It differs from Sugar chiefly in its conſiſtence, never aſſuming a concrete or ſolid form (*u*), and its poſſeſſing a greater laxative, ex-

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(*u*) *Concrete form.*] Though Honey does not concrete into a cryſtalline or ſaline maſs by the uſual methods of evaporation and cryſtallization; I have nevertheleſs made it to aſſume that form by a variation of the proceſs; by treating it in the manner practiſed for the refining of Sugar. The Honey, clarified and boiled down to a due conſiſtence, and then poured into a conical mould perforated at the bottom, concretes into a ſolid maſs, and diſcharges a liquid treacly matter. The lump, at firſt browniſh or yellowiſh, by ſpreading moiſt clay upon the ſurface becomes white: It is moderately firm, of a cryſtalline appearance, and a very ſweet taſte, different from that of Sugar, and not quite the ſame with that which the Honey had at firſt.

HONEY. pectorant and detergent quality. It is obſervable that ſome have a peculiar averſion to its uſe, and cannot bear it even externally. In the ſhops, it is employed as the baſis of ſome electaries, medicated Honies, Oxymels, &c. which may be ſeen in diſpenſatories. It is purified from waxy, farinaceous and other like matters, by liquefying it in a gentle warmth, taking off the ſcum which ariſes to the ſurface, and paſſing the Honey through a linen cloth. It ſhould never be boiled, as its finer and more ſubtile parts are in that proceſs diſſipated; and an ungrateful impreſſion made upon it by the heat. The liquor which ariſes even in the heat of a Water-bath is manifeſtly impregnated both with the ſmell and taſte of the Honey: It amounts to three ounces upon eight of Honey. The Honey thus inſpiſſated diſſolves, as at firſt, both in Water and in rectified Spirit of Wine; only a ſmall portion being left. The vapour which exhales in the boiling, takes flame upon the approach of a candle, diffuſes its ſmell throughout the houſe, and will draw together a whole ſwarm of Bees from a great diſtance. In diſtillation by a gradual fire without addition, thirty-two ounces of Honey yielded upwards of twenty-four of an oily acid ſpirit, with a little empyreumatic Oil: The remaining coal weighed upwards of ſeven ounces, and like that of Manna, could ſcarce be reduced into aſhes. The acid ſpirit has been ſaid to diſſolve gold and quickſilver; but I have not obſerved it to have any action on either of theſe bodies, or to differ in its diſſolving power from the acid of Vinegar. Nor does there ſeem to be any foundation for the virtue commonly aſcribed to this ſpirit and to the diſtilled Water of Honey, of making hair grow. The principal conſumption of Honey is in ginger-bread, and for making Mead and Metheglin. Thirty ſix ounces of Honey, diluted with four quarts of warm Water, and fermented with a little yeaſt, yielded on diſtillation a pint of phlegmatic ſpirit, which by rectification was reduced to eight ounces.

II BEE-GLUE. THE bees employ in building their combs two kinds of ſubſtances, one, a ſoft, unctuous, glutinous

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BEE-GLUE.

matter, the other, Wax. The firſt ſerves as a Glue for cementing the combs to the hives, and cloſing up the cells: Hence it is called BEE-GLUE. A portion of this commonly adheres where the bees alight, and may be ſcraped off from about the entry of the hive: It was formerly kept in the ſhops under the name of *Propolis*, but is now entirely in diſuſe.

III. WAX.

Whence procured.

WAX is collected from leaves and flowers, particularly from thoſe flowers which are well furniſhed with ſtamina, or threads bearing little knobs on the top: The ſtamina of the common Poppey and Rocket yield to the bee abundance.—In the *Ephemerides naturæ curioſorum* there are two accounts of a little waxy matter being obtained in beating Roſes. In ſome parts of America, a kind of Wax is collected from trees.

Method of whitening.

Wax is at firſt white, as we ſee in the cells of young bees: The yellow colour which it acquires afterwards is ſuppoſed by ſome to proceed from the Honey. This colour is not permanent: By kneading the Wax, or by long keeping, it loſes its lively yellow and becomes whitiſh: Melted by common fire, it turns darker coloured, but by expoſure to the ſun it grows at length white as ſnow. Thoſe who bleach Wax for candles and other uſes, caſt it into thin plates by melting and pouring it upon a roller turning round in cold water, and ſpread the fine ſhivers into which it is thus divided, upon a linen cloth, in the ſun: When the outſide is ſufficiently whitened, the Wax is melted and caſt into thin plates again, that a freſh ſurface may be expoſed to the ſun, and this proceſs three or four times repeated. The bleaching is begun and ended with the warm part of the year.—The Wax is procured at firſt by melting over a gentle fire, the matter left after the expreſſion of the Honey, ſcumming off the lighter impurities which ariſe to the ſurface; and pouring it into a moiſt wooden veſſel: When the cake of Wax congeals, the groſſer part at the bottom is pared away.

Examined by menſtrua and diſtillation.

Bees wax, when in perfection, is of a deep, bright yellow colour, and a ſtrong agreeable Honey-like ſmell.

Wax. ſmell, both which it loſes upon long keeping. In bleaching, the ſmell is deſtroyed along with the colour. It is not whitened, as ſome pretend, by Spirit of Wine: by the aſſiſtance of heat, it totally diſſolves in that menſtruum, and when recovered from it again proves darker coloured than at firſt. Water has no action on it. Diſtilled by a gradual fire, without addition, it almoſt totally ariſes in form of a butyraceous Oil, which grows ſtiff in the cold like Wax itſelf, and liquefies again on applying heat. Four ounces of Wax yielded four ounces of Oil, wanting only about a ſcruple; that which comes over firſt is whitiſh; that which follows more of a browniſh hue. Boerhaave recommends this Oil as an extraordinary remedy againſt chaps in the breaſts. The principal uſe of Wax in medicine, is in cerates, plaſters, ointments, &c. It is uſed alſo internally as an ingerdient in the *Balſamum Locatelli*, which is given in aſthmatic diſorders, and for healing ulcerations, but probably on no juſt foundation. Wax is a tenacious ſubſtance not made for the human ſtomach to digeſt: The Turpentines and Balſams, whatever may be their good effects when externally applied, heat and ſtimulate when given inwardly, and thus ſeem more likely to aggravate the febrile ſymptoms that accompany conſumptive diſorders, than to heal the ulcerated lungs, which how great ſoever we ſuppoſe their healing power, they certainly cannot reach. The mechanic uſes of Wax are numerous, as for taking impreſſions, for anatomical injections, candles, Sealing-wax, for waxing thread, as a varniſh to cover Copper for etching with Aqua fortis, &c. &c.

IV. Lacca. GUM LAC, ſo called, has been ſuppoſed to exude in the Eaſt Indies, from punctures made in the barks of trees by certain winged inſects. It appears to be truly a kind of Wax, collected by the inſect, and formed into regular cells like the honeycomb. It is found upon different kinds of trees, and not only upon living trees, but on ſticks which the Indians place in the ground for the inſect to work upon. There are indeed natural exudations, called L

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from their uſe in lacquers and varniſhes; but theſe are entirely different from the Lac brought to us.

LACCA.

Different ſorts, uſes, &c.

Gum lac is of a red colour, not of itſelf, but from the inſect. In many of the cells there are dead inſects, whoſe colour is gradually diffuſed by the ſun's heat, through the whole ſubſtance of the cell: Such maſſes as the inſects have not died in, or have not been expoſed to the action of the ſun, or have been gathered too ſoon, have little or no redneſs. The greateſt quantities are brought into England and Holland, from Malabar, Bengal, Pegu, Sumatra, &c. in maſſes adhering to the ſticks or branches of the tree, and hence called Stick-lac, *Lacca in baculis, ramulis, ſurculis.* This is employed in ſundry places for dying ſcarlet (z), and for colouring leather: It is with this that the Turkey leather is ſtained. The Lac, beat off from the ſticks, is reduced into a groſs kind of powder, and a tincture extracted from it; after which the remaining matter is dried, and ſold under the name of *Lacca in granis* or Seed-lac. The Stick-lac, melted over a gentle fire, and poured off from its impurities upon a Marble, forms dark-coloured cakes in appearance like Glaſs of Antimony; called *Lacca in tabulis* or Shell-lac. This laſt ſort is the deareſt of the three, and

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(z) *Dying Scarlet.*] The ſcarlet dyed with Lac is leſs beautiful than that with Cochineal, but of greater ſolidity. Mr. Hellot obſerves that when employed in ſubſtance, the reſinous matter of the Lac is apt to melt in the hot liquor, and ſtain the cloth; and hence directs the colouring ſubſtance to be previouſly ſeparated in the form of a lake.

For this purpoſe, half a dram of powdered Comfry root is to be boiled in a quart of water for a quarter of an hour; and ſome powdered Gum Lac digeſted in the decoction for two hours: The tincture appears of a fine crimſon colour, and the remaining Gum (if the quantity of liquor has been ſufficient to extract all its tinging matter) of a pale ſtraw colour. The tincture being poured off clear, and a ſolution of Alum gradually added to it, the colouring matter ſubſides, and the liquor remains colourleſs: The quantity of dried Fecula amounts to a little more than one fifth the weight of the Lac.

For dying this Fecula is diſſolved in warm water, with the addition of a proper quantity of ſolution of Tin; and the fiery-red liquor poured into boiling water impregnated with Tartar, after the ſame manner as when Cochineal is uſed. The only difference is, that the Fecula of Gum Lac diſſolves more difficultly than Cochineal, and hence is moſt conveniently diſſolved firſt by itſelf; and that it affords ſomewhat more colour. If, [illegible]ead of Tartar and ſolution of Tin, any fixed alcaline Salt be uſed, the [illegible]id red of the Gum lac changes into the colour of red wine lees: Sal ammoniac changes it to a Cinnamon or Cheſnut colour.

LACCA. uſed chiefly in Sealing-wax. The lac moſt common in the German ſhops is the Seed-lac, which generally has had a part of its colour extracted. This is in ſmall tranſparent pieces, like little Garnet ſtones. Its goodneſs is in proportion to its dark-browniſh red colour; but it is never equal to the Stick kind. Beſides being of a red colour in the maſs, it ought to tinge the ſpittle of a purple red.

Chemical examination. Gum-lac may be looked upon as a very hard ſort of Wax, tinctured with an animal red of the Cochineal kind. The beſt Stick-lac, or the part which lies next to the wood, and which is moſt impregnated with inſects and with colour, yields in burning a degree of ſtench like that of animal matters. The Seed-lac does not diſſolve in water, nor in oils. I have digeſted it with a conſiderable heat both in expreſſed Oils, as that of Almonds, and in ſundry diſtilled ones as thoſe of Aniſeeds, Turpentine and Thyme, without being able obtain any other than a dilute tincture: The Oil of Thyme extracted moſt. I digeſted it alſo, with a heat raiſed to ebullition, in water acidulated with the Spirits of Vitriol, of Nitre and of Sea-ſalt, and in diſtilled Vinegar; and with theſe alſo obtained only dilute tinctures: That with the nitrous acid was the paleſt. To Alum-water, it gave a beautiful tranſparent red. Alcaline Salts extracted more than the acidulated liquors, the tincture being thick, and of a quite dark violet-purpliſh red: The quantity diſſolved, however, was but ſmall. Of the concentrated mineral acids, the vitriolic extracted exceeding little, the marine ſomewhat more, and the nitrous nothing: This laſt not only acquired no colour itſelf, but deſtroyed that of the Lac, rendering it of a quite pale yellow. Spirit of Wine ſeems at firſt to have little action on Lac, extracting only a moderate tincture; but by perſeverance I have made it diſſolve at length nearly the whole: From ſixteen ounces of Lac I obtained fifteen of ſpirituous extract. The ſolution is not red, but of a brown colour: It does not paſs through a filter, looks like a thick Mucilage, and does not eaſily part with the ſpirit. The ſame quantity of Lac, treated firſt with water,

ter, yielded one ounce and ſix drams of extract; after which it gave out to rectified ſpirit fourteen ounces. Sixteen ounces of Seed-lac, diſtilled in an open fire, yielded nine ounces and ſix drams of a Butter or thick empyreumatic Oil, ſimilar to that of common Wax; after which aroſe one ounce and ſix drams of a watery liquor not manifeſtly acid or alcaline: The reſiduum weighed two ounces and a half. LACCA.

Lac was formerly an ingredient in ſome officinal compoſitions; and in many diſpenſatories, a tincture of it in Alum-water is ſtill retained. It ſeems to be an article that medicine can very well ſpare, as it contains nothing of any remarkable activity. Its principal uſe is as a colouring drug, and for Sealing-wax: Thoſe who employ it in varniſhes, gain from it but little, if managed according to the common receipts.

SECTION III.

Of PLANTS *or their* PARTS *in ſubſtance.*

CLASS I.

GUMMY VEGETABLES.

GUMMY VEGETABLES.

OF the plants whoſe prevailing principle is a gummy or mucilaginous ſubſtance, Marſhmallow and Comfry are the chief. We may obſerve in both theſe plants, what obtains but in few, that the roots, leaves, and ſeeds, agree in their chemical compoſition, and differ only in the quantity of Mucilage they afford; the roots yielding conſiderably more than any of the other parts. They contain alſo a reſinous matter; but the Gum is nevertheleſs their characteriſtic, as the reſin has no particular taſte or ſmell, nor the plant any medicinal activity but what reſides in its Gum. As both plants are inodorous and inſipid, they give over nothing, or nothing conſiderable in diſtillation, either with water or with ſpirit.

I. MARSHMALLOW.

THE MARSHMALLOW is called *Althæa*, as ſome ſuppoſe from its healing quality (αλθαινω, *Sano*;) *Biſmalva*, *Malvaviſcus*, *Ibiſcus*, *Eviſcum*, from its viſcoſity, and from its having twice the power of the common Mallow. The ſpecies here intended is that which Caſpar Bauhine diſtinguiſhes by the name *Althæa dioſcoridis & plinii*: It grows wild in watery places, though cultivated alſo in gardens. The root is pretty long, about the thickneſs of the finger, brown on the outſide, and white within.

Two ounces of the dry root yielded with water, ten drams fifty grains of mucilaginous extract; and afterwards with ſpirit forty-one grains of Reſin. The ſame quantity, treated with ſpirit, gave ſix drams of

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MARSH-MALLOW.

a reſinous extract (*a*), a conſiderable portion of the Mucilage diſſolving in that menſtruum along with the Reſin: The remainder, boiled in water, gave out five drams and forty eight grains of pure Mucilage. From two ounces of the dry leaves were obtained, by water, five drams and two ſcruples of mucilaginous extract; and afterwards by ſpirit, three drams thirty-three grains of a reſinous one. From the ſame quantity, treated firſt with ſpirit, and then with water, were gained four drams two ſcruples of a reſinous maſs, and afterwards three drams thirty-eight grains of Mucilage —The indiſſoluble earthy matter amounts in the roots to ſomewhat more than one fourth, and in the leaves to about one half of their weight:

II. COMFRY.

COMFRY, from the extraordinary power of conſolidating wounds formerly aſcribed to it, has received the names of *Conſolida*, *Solidago*, and *Symphytum*. The officinal ſpecies is that which bears purple flowers, called Male Comfry, *Symphytum flore purpureo quæ mas*, C. B: It grows wild in moiſt fields and meadows. The root is about an inch thick, black on the outſide, and white within.

From two ounces of the dry root were obtained by water, twelve drams of gummy extract; and afterwards by ſpirit, eight grains of Reſin. It was pretty remarkable, that on digeſting the gummy extract in rectified ſpirit, near one half of it diſſolved; and that it was not made tenacious or coheſive by the ſpirituous liquor, but continued powdery. Two ounces of the root, treated with rectified ſpirit at firſt, gave four drams of reſinous extract, and afterwards with water, nine drams of Mucilage.

Theſe plants are employed medicinally as emollients and incraſſants, externally as well as internally; in plaſters, ſalves and ointments; in infuſions for chapt lips, and other like complaints; and by ſome of the French oculiſts for diſorders of the eyes. The

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(*a*) *Six drams of reſinous extract.*] I have not obſerved the quantity of [illegible]ſinous matter to be ſo large as in the author's experiment. From two [illegible]unces of Marſhmallow root, digeſted and boiled in freſh parcels of ſpi[illegible]t, I obtained but two drams: The extract had more of a ſweetiſh taſte than that made with water; together with the light ſmell obſervable in the root itſelf, COMFRY. Marſhmallow root, boiled with red ſaunders, or in red Wine, and afterwards dried, is uſed as a dentifrice, under the name of French Althæa.

III FENUGREEK.

THE ſeeds of FENUGREEK may be referred to this claſs, their prevailing principle being a mucilaginous matter: They are ſometimes uſed as an emollient in external applications, but chiefly againſt coughs and other like diſorders in cattle. The plant (*Fænum græcum ſativum, C. B.*) is in ſome places ſown in fields: It has a papilionaceous flower, and produces its ſeed in pods.

The ſeed are of an oblong flattiſh quadrangular figure, rounded at one end, covered with a yellowiſh ſkin, which acquires a darker reddiſh or browniſh colour by age; internally of a very pale yellow; of a ſweetiſh but not agreeable ſmell; and an unpleaſant, bitteriſh, ſlimy taſte. They contain a portion of expreſſible Oil, intimately blended with the reſinous and mucilaginous principles; by the mediation of the firſt of which the Oil is extracted by ſpirit of Wine, though it in great meaſure ſeparates afterwards during the evaporation of the tincture.

Sixteen ounces of the ſeeds yielded with water eleven drams and a ſcruple of a mucilaginous ſomewhat bitteriſh extract; and afterwards with ſpirit, half a dram of an unctuous Reſin. On applying ſpirit at firſt, I obtained from the ſame quantity, four drams and a half of a very ungrateful reſinous extract; after which water took up ſix drams and a half of Mucilage. The diſtilled water ſmells a little of the Fenugreek, but gives no appearance of any eſſential Oil: It ſoon loſes the ſpecific flavour of the ſeeds, but continues ungrateful.

CLASS II.

RESINOUS VEGETABLES.

RESINOUS VEGETABLES.

RESINOUS VEGETABLES are thoſe, whoſe diſtinguiſhing taſte, medicinal activity, or colour, reſide in their Reſin; and which do not contain Gum or Mucilage enough, to render any conſiderable

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Resinous Vegetables.

quantity of the Reſin ſoluble by infuſion or digeſtion in water. By ſtrong coction in water, great part of the Reſin may often indeed be melted out; but even in this caſe, it is far leſs perfectly extracted than by moderate digeſtion in rectified ſpirit. The ſubſtances of this claſs have little or no ſmell, and give over little or nothing, in diſtillation, with water or with ſpirit.

Gums or Mucilages are in all plants nearly the ſame; but Reſins differ extremely from one another. The inſipid and inactive Red-ſaunders; the aſtringent and bitter Peruvian Bark; the pungent Guaiacum and Pimpinella; the more acrid Pellitory and Staveſacre; the purgative Jalap, Turpeth, Mattaliſta, Hermodactyl; the emetic Ipecacoana and Aſarum; the more violent Bryony, Agaric, Colocynth, Hellebore; and the deleterious Coccognidia, Cocculus Indus, Nux vomica, and Faba ſancti Ignatii, owe their qualities to their reſinous principle.

Red-Saunders.

RED-SAUNDERS is a hard, compact, ponderous wood, of a dark blackiſh-red on the outſide, and a light red colour within; of no particular ſmell or taſte. It is brought from the Coromandel coaſt, and from Golconda: Of the tree we have no certain account. Its principal uſe is as a colouring drug. Thoſe whoſe buſineſs it is to raſp and grind it into powder, probably employ certain ſaline or other additions to improve the colour; whence the remarkable differences in the colour of powdered Saunders prepared in different places: That of Straſburg is of the deepeſt and livelieſt red: Some ſorts are of a dead, dark red, and ſome of a pale brick red; ſome incline to purple or violet, and ſome to brown.

The colour of this wood reſides wholly in its Reſin, and hence is extracted by rectified ſpirit, whilſt water, though it takes up a portion of mucilaginous matter, gains no tinge, or only a ſlight yellowiſh one (*b*).

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(*b*) *Gives no red colour to water.*] This property readily diſtinguiſhes Red-ſaunders from Brazil-wood, which ſome have confounded with it; that wood communicating its red colour to water as well as to ſpirit.

RED-SAUNDERS.

From two ounces of the wood were obtained by Spirit of Wine, three drams and a half of reſinous extract; and afterwards by water, a ſcruple of Mucilage. By applying water at firſt, I obtained from two ounces, two drams and ſix grains of a tough mucilaginous extract, which could not eaſily be reduced to dryneſs: The remainder ſtill yielded with ſpirit, two drams of Reſin. The indiſſoluble matter weighed in the firſt caſe, an ounce and half and fifteen grains; in the latter, nineteen grains leſs. Neither the diſtilled water nor ſpirit had any remarkable taſte or ſmell.

The red colour of Saunders appears to be no other than a concentrated yellow, for by bare dilution it becomes yellow: A grain of the reſinous extract,

ALKANET ROOT.

THE roots of Alkanet agree in the above reſpect with Saunders-wood, but differ from it remarkably in others. They impart an elegant deep red to pure Spirit of Wine, to Oils, to Wax, and to all unctuous ſubſtances: I do not know of any red drug that tinges Oil of ſo fine a colour. To water, they give only a dull browniſh. The ſpirituous tincture, on being inſpiſſated to the conſiſtence of an extract, inſtead of preſerving its fine red, like that of Saunders, changes to an unſightly brown. Volatile ſpirits have been ſaid to gain from this root a beautiful violet or amethyſt colour; but I have not found, that they extract any other than a dull reddiſh brown.

The Alkanet plant is a ſpecies of Bugloſs, named by Tournefort *Bugloſſum radice rubra, ſive anchuſa vulgatior floribus cæruleis.* It is a native of the warmer parts of Europe, and cultivated in ſome of our gardens: The greateſt quantities are raiſed in Germany and France, particularly about Montpelier, from whence we are chiefly ſupplied with the roots.

The Alkanet root produced in England is much inferior in colour to that brought from abroad; the former being only lightly reddiſh, the latter of a deep, purpliſh red. This has induced ſome to ſuſpect, that the foreign roots owe part of their colour to art; but a chemical examination teaches otherwiſe. The colouring matter is found, upon experiment, to be of the ſame kind in both, and to differ in ſeveral of its properties from that of all the other known red drugs; ſo that no artifice appears to be practicable without diſcovery, unleſs it was concentrating the colour of two roots into one, or ſuperſaturating one root with the colour extracted from another.

The principal uſe of Alkanet root is for colouring Oils, unguents, lip ſalves, plaſters, &c. Wax tinged with it, applied on warm Marble, ſtains it of a fleſh colour, which ſinks deep into the ſtone: The ſpirituous tincture gives a deep red ſtain.

The colour of this root is confined to the cortical part, the pith being whitiſh: Hence as the ſmall roots have more bark, in proportion to their bulk, than the large ones, thoſe alſo contain moſt colour.

diſſolved

RED-SAUNDERS.

diſſolved in an ounce of rectified ſpirit, tinges it red; but this ſolution mixed with a quart of freſh ſpirit, gives only a yellow hue. Hoffman reports that this Reſin does not give a tincture to any kind of Oil: I have tried five Oils, thoſe of Amber, Turpentine, Almonds, Anniſeeds and Lavender: It gave no colour to the two firſt, but a deep red to the laſt, and a paler red to the other two.

II. PERUVIAN-BARK.

PERUVIAN-BARK, *Cortex Peruvianus*, called, from its efficacy againſt intermitting fevers, *Febrifugum Peruvianum*, *cortex antifebrilis* and *antiquartius*; and from a cure performed by it on the Lady of Count del Cinchon Viceroy of Peru, *Cortex China china or Chinchina*, *Kinkina*, *Quinquina*, *Comitiſſæ*, &c. was firſt brought into Europe, in the year 1649, by Cardinal de Lugo, who was then the Spaniſh Viceroy in the Weſt-Indies. It continued for ſome time a very lucrative ſecret in the hands of the Jeſuits, who reduced it into powder the better to diſguiſe it, and ſold it for its weight in Gold; whence its names *Pulvis Jeſuiticus*, *Pulvis patrum*, *Pulvis Cardinalis de Lugo*.

The tree, called by Ray, *Arbor febrifuga Peruviana*, *China china*, *&* *quinquina*, *&* *ganaperide dicta*, is plentiful on the hills near the city Loxa in the province of Quito in Peru. It is ſaid, that the trees which grow at the bottom of the hills, have the thickeſt bark, ſmooth and whitiſh on the outſide, clear or yellowiſh-brown within, the leaſt bitter, and of the leaſt virtue; that the bark of thoſe on the top is ſomewhat bitterer, thin, full of protuberancies, of a blackiſh colour on the outſide, and of a dark brown within: That thoſe produced about the middle height yield the bittereſt and beſt bark, not ſo ſmooth and pale coloured as the one, nor ſo rugged and dark coloured as the other. Vaillant, a celebrated botaniſt of Paris, aſſured me that he knew ſix ſorts; and confirmed the account given by Lemery and Pomet, that Potoſi affords the beſt; that this is much browner, bitterer, more aromatic and more pungent, than the Bark of Quito. But our buſineſs is to

chuſe

chuſe the beſt of what is brought to us. This is externally of a blackiſh brown, and internally of a dark cinnamon colour, ſomewhat unequal on the ſurface, compact, firm, and not eaſy to break, of a moderately bitter aſtringent taſte, with a mixed kind of aromatic and muſty flavour. The large thick pieces are ſeldom good: Thoſe which are rolled up into quills like Cinnamon, are apt to have foreign matters lodged within, and therefore ſhould be broke and examined before we pulverize them for uſe.

Mr. Boulduc obtained, from a pound of Bark, only five drams and a ſcruple of ſpirituous extract: In my experiments, a pound yielded, with rectified ſpirit, ten drams and two ſcruples of reſinous, and afterwards with Water, five drams of gummy extract: On applying Water at firſt, I obtained ſeven drams and a ſcruple of gummy, and afterwards by ſpirit, ſix drams of reſinous extract. Theſe experiments ſhew a remarkable difference betwixt Peruvian bark and Caſcarilla, which is ſuppoſed to be of the ſame kind: From a pound of Peruvian-bark, we obtain at moſt but two ounces and five ſcruples of extract, reckoning the gummy and reſinous together (x); whilſt a pound of Caſcarilla yields upwards of ſeven ounces and a half: The latter contains alſo an eſſential Oil, of which we diſcover nothing in the former. The extract made from Bark by applying Water at firſt, taſtes conſiderably bitter and aſtringent, but not near ſo much ſo as that made by ſpirit—The principal uſe

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(x) *Quantity of extract.*] Different ſorts of Peruvian-bark differ conſiderably in their yield of extract. Thoſe which I examined afforded a much larger quantity of reſinous extract than the author obtained from his.

It is obſervable of this drug, that its aſtringency reſides wholly in its Reſin, which does not appear to be in any degree ſoluble in watery liquors; but its bitterneſs in a gummy-reſinous ſubſtance, or ſuch an one as is diſſoluble both in Water and in Spirit. Both principles may be extracted by boiling in Water; the Reſin melting out by the heat, and rendering the liquor turbid: The decoction, in this ſtate, taſtes aſtringent as well as bitter, but on ſtanding it depoſites the Reſin and becomes clear, and then proves ſimply bitter. Repeated coction and large quantities of Water are neceſſary for extracting all the virtues of [illegible] Bark: The Reſin melts out in the firſt boilings; the decoctions m[illegible] afterwards are tranſparent and bitter, without the leaſt turbidneſs [illegible] aſtringenc

of

PERUVIAN-BARK.

of this Bark is in the diſorder againſt which it was at firſt introduced, intermitting-fevers: It is given to half a dram and upwards, every fourth hour during the intermiſſion, in conjunction with Sal ammoniac or vitriolated Tartar, which prevent its occaſioning the ill conſequences that it is apt to do by itſelf.

III. GUAIACUM.

GUAIACUM, *Lignum guaiacum, guaiacan, benedictum, ſanctum, vitæ, Palus ſanctus, Palma ſancta,* is the wood of two kinds of trees growing in America, called by Plukenet, the one *Guaiacum Jamaicenſe, &c.* the Jamaica Guaiacum-tree, with bright green roundiſh leaves like thoſe of the Maple; the other *Euonymo adfinis occidentalis, &c.* an occidental nut-bearing tree, allied to the Euonymus or Spindle-tree, with winged leaves like thoſe of butcher's broom, and a fungous bark at the joints. The wood comes over in large pieces, weighing four, five, and more hundred weight, from Jamaica, Mexico, Portorico, Borigue, St. Domingo, and other parts of the Weſt-Indies: The tree has been raiſed alſo in Europe, but proved far inferior in quality to that produced in its native climate, and yielded nothing of the reſinous juice which it plentifully bleeds there. (See page 26.)

Wood.

This wood is remarkably hard, compact, and ſo heavy as to ſink in Water, of a brown, or yellowiſh brown colour, often blackiſh, or marbled as it were with different colours: When the tree is ſtanding or newly felled, the bark adheres ſo firmly as not to be got off with iron tools; after lying for ſome time it ſeparates eaſily. On account of its great hardneſs, ſolidity, and indiſpoſition to crack, it is employed by the turners and others for ſeveral of the more curious mechanic uſes.——In Holland, at Hamburg and other places of large commerce, it is raſped in work-houſes eſtabliſhed for that purpoſe, after the ſame manner as the Colouring-woods; and from theſe the druggiſt and apothecary are ſupplied.

Guaiacum is a very reſinous Wood: On expoſing it to a moderate heat, the Reſin viſibly melts out. By digeſtion in highly rectified Spirit of Wine, I ob-

GUAIACUM.

tained three ounces and a half of reſinous extract from ſixteen ounces of the Wood: Such as had been boiled in Water till that menſtruum wou'd take up no more, yielded ſtill, with rectified Spirit, two ounces of Reſin upon the pound. Water applied at firſt extracts an ounce and a half, and after ſpirit has performed its office, half an ounce and two ſcruples, of gummy matter. The indiſſoluble part, when the gum was extracted firſt, weighed twelve ounces and a half; when the Reſin was firſt extracted, only twelve ounces and two drams. Theſe experiments were made with chips of a good reſinous kind of Guaiacum: The raſped Wood commonly ſold yields leſs of a reſinous and more of a gummy extract. From a pound of good raſpings I obtained by Spirits two ounces and ſix drams, and afterwards by Water one ounce: Another pound of the ſame, treated with Water at firſt, gave two ounces, and afterwards with Spirit one ounce and ſix drams.

A ſtrong decoction of Guaiacum is uſed as an alterative diet-drink in venereal, cancerous, and other diſorders from an impurity of the blood and juices, Hoffman recommends the ſpirituous extract (which is the moſt active preparation) as a high antidote againſt the venereal poiſon, provided it be uſed properly according to the laws of medicine. He mentions alſo another reſinous preparation of this Wood, under the title of "A ſingular Reſin, of a ſtimulating " errhine quality, and poſſeſſing alſo a corroborating " power; highly friendly to the nervous parts of the " head:" This, according to his account, is the Reſin that precipitates in boiling down a watery decoction of the Wood.

A pound of Guaiacum Wood, diſtilled in an open fire, gave three ounces and a half of Spirit, and one and a half of empyreumatic Oil. Some report, that the ſpirit is of the neutral kind; that it makes no effervеſcence either with alcalies or with acids, and that it forms an ink with Vitriol: I have obſerved that it does effervеſce conſtantly with alcalies, though not very ſtrongly, on account of its oily matter,

which

Guaiacum.

which ſheathes the acidity; and that with Vitriol it ſtrikes a blackiſh brown colour, but by no means an inky blackneſs. I have not found that a decoction of the Wood changes Syrup of Violets red, as ſome relate that it does; nor that the Wood in the maſs, in chips or in raſpings, heated by itſelf or with Oil, would take fire on the affuſion of Oil of Vitriol, or of a mixture of Oil of Vitriol with Nitre, or its concentrated Spirit.

Bark.

Of the Bark of Guaiacum, there are two kinds, one ſmooth, the other unequal on the ſurface. The former is ſaid to be the Bark of the firſt of the trees above mentioned, the other of the ſecond. Some confine the name *Guaiacum* to the Wood and Bark of the firſt ſort, and that of *Sanctum* to the latter; but there is no remarkable difference betwixt the two. Greateſt part of the Bark that comes to us is moderately ſmooth; externally of a dark grey colour, with blackiſh yellow and greeniſh ſpecks, internally yellowiſh, reddiſh or browniſh; compoſed of plates or a number of thinner rinds applied ſucceſſively upon one another; compact and heavy; of a bitteriſh diſagreeable taſte.

Eight ounces yielded one ounce and four ſcruples of reſinous extract, and afterwards five drams and one ſcruple of a gummy one. The ſame quantity, treated firſt with Water and then with Spirit, gave ten drams one ſcruple of gummy, and four drams of reſinous extract. The indiſſoluble part weighed, in both caſes, ſix ounces and two drams.

IV. Burnet Saxifrage.

PIMPINELLA, or *Bipennula*, ſuppoſed to be ſo called from its ſtanding in double rows like feathers, is an umbelliferous plant, growing wild in dry, ſandy, gravelly grounds. The ſpecies directed for medicinal uſe is the *Pimpinella Saxifraga major umbella candida*, *C. B.* or greater Burnet Saxifrage with white flowers; but we may take promiſcuouſly the roots of the ſmaller ſorts, provided they are not produced in moiſt rich ſoils: One and the ſame ſpecies differs more in different ſoils, than different ſpecies do in one ſoil. The roots are of a pale yellowiſh colour, about the thickneſs of the little finger at moſt, of a peculiar ſmell, and an acrid burning taſte. This

BURNET SAXIFRAGE.

This root contains a portion of eſſential Oil: On diſtilling a large quantity with Water, the diſtilled liquor is not only impregnated with its flavour, but ſome particles of actual Oil may be diſtinguiſhed; much too inconſiderable, however to entitle the plant to a place among the oily ones. The pungency and diſtinguiſhing taſte of the Pimpinella reſide wholly in its Reſin: What Water extracts, diſcovers only a ſweetiſh taſte, with no remarkable pungency.

Two ounces of the root, cut in pieces, yielded with Water, ſix drams and a ſcruple of gummy extract; and afterwards, with Spirit, only two ſcruples of a reſinous one; this laſt was in taſte extremely nauſeous. Two ounces more, treated firſt with Spirit, gave four drams of reſinous extract; and afterwards with Water two drams two ſcruples of an inſipid and inodorous gum. It is obſervable, that the ſpirituous extract is in taſte far more diſagreeable than the tincture, and impreſſes a particular diſtguſtful oilyneſs. In effect this root contains a groſs oily matter, of the expreſſible kind; which rectified ſpirit extracts along with the Reſin, and which in the tincture is diluted and concealed by the ſpirit, but ſeparates and diſcovers itſelf on drawing off the menſtruum. A ſaturated tincture or eſſence is therefore the beſt preparation of Pimpinella.

This root is a powerful reſolvent and aperient medicine: It promotes perſpiration and urine, purifies the blood and juices, and proves remarkably ſerviceable in diſorders of the fauces, catarrhs, infarctions of the breaſt by viſcid phlegm, obſtructions of the viſcera, and the conſequences of ill managed mercurial ſalivations. A mixture of the eſſence with Syrup of Violets, or a tea-ſpoonful of the eſſence by itſelf, is a common medicine in Germany, for ſore throats.

V. PELLITORY.

PELLITORY, called from the fiery taſte of its root *Pyrethrum*, is a plant with Fennel like leaves, and a flower like that of the common purpliſh daiſy: Hence it is named by Caſpar Bauhine *Pyrethrum flore bellidis*. It is generally ſaid to be an oriental plant: Pomet
lates that it grows plentifully about Tunis, and

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the Pellitory uſed in France is imported from thence by the way of Marſeilles. Some report that it is found on the hills of Switzerland and Italy; but of this I find no account in the Italian botaniſts: Nor indeed is the plant deſcribed by any of the modern botaniſts I know of. Thus much is certain, that it does not grow in the dutchy of Magdeburg, as Schurtzius and others affirm. We find there a ſpecies of *Pharmica* whoſe roots are called by ſome Pellitory, and uſed like it as a Maſticatory; but none of the true Pyrethrum.

Pellitory.

Pellitory roots are ſold in bundles, tied up with ſtrong twigs: They are ſeldom ſo thick as the little finger, and have generally a piece of the woody ſtalk at the head: The beſt are dry, compact, of a brown colour, not eaſy to cut with a knife. The characteriſtic property of this root is its hot burning taſte, which reſides not in a ſaline matter, as Lemery, Juncker and others affirm, but wholly in a reſinous one; water extracting a little of it, but rectified ſpirit the whole. It is obſervable, that notwithſtanding the extreme acrimony of this root, the quantity of matter on which that quality depends, is very ſmall, ſcarcely amounting to a ſcruple in an ounce.

Two ounces of the root, treated with rectified ſpirit, gave no more than two ſcruples of extract, in which, as in other extracts made by ſpirit at firſt, a portion of gummy matter was retained along with the Reſin; the reſiduum digeſted with water, gave nine drams and a half of gummy extract, ſix drams, all but twelve grains remaining undiſſolved. On inverting the procedure, and applying water at firſt, I obtained from the ſame quantity of Pellitory, ten drams of gummy extract, and afterwards by ſpirit only one ſcruple of Reſin, the undiſſolved part weighing five drams thirty-ſeven grains.

Both the ſpirituous extracts were exceſſively fiery; that made after water did not diſcover its fierineſs in the mouth ſo ſoon as the other, as being more purely reſinous, and conſequently more difficultly acted upon by the Saliva, on account of the previous ſeparation of the gummy parts by the water. The watery extracts

PELLITORY.

tracts could ſcarce be reduced into an uniform coherent maſs, being diſpoſed rather to a crumbly or powdery conſiſtence. Water diſtilled over from the root, elevated a little of its acrid matter, perceptible upon keeping the liquor for ſome time in the mouth.

The principal uſe of this root is as a maſticatory in paralytic and lethargic diſorders, particularly in palſies of the tongue and in tooth achs, either by itſelf or made into troches with other ſubſtances, and as an ingredient in ſtimulating cataplaſms. It is ſometimes likewiſe given internally, for heating, ſtimulating, ſtrengthening the ſtomach, and diſſolving viſcid phlegm. The vinegar-makers employ it for making their Vinegar ſharper.

VI. STAVESACRE.

STAVESACRE, *Staphiſagria*, is referred by ſome botaniſts, from its flowers, to the genus of Larkſpurs; by others, from its ſeeds, to that of Aconites. Tournefort calls it "Larkſpur with leaves like thoſe of the Plane-tree;" and Plukenet "the burning Aconite, with leaves almoſt like thoſe of Ricinus, and a large blue flower." It is a native of the ſouthern parts of France, of Italy and Spain, particularly Apulia and Calabria; but the greateſt quantities are met with in Dalmatia and Iſtria: It loves ſhady places.

The part made uſe of is the ſeeds, of which four, five, or ſix are commonly joined together in one cod, ſo as to appear one roundiſh kernel. The ſingle ſeeds are of an oblong, irregularly triangular figure: Two of the ſides, by which each ſeed had been joined to two others, are flat; the third, contiguous to the cod, is rounded. They are covered on all ſides with a rough rugged membrane, which when perfectly ripe is of a brown colour: under this lies another thin ſkin, which incloſes a white kernel, of a diſagreeable, bitteriſh, hot taſte: By age, the kernel becomes yellow and browniſh.

Theſe ſeeds are employed chiefly in ointments for deſtroying cutaneous inſects, whence their name *Grana pedicularia*; and as a maſticatory for tooth-achs, &c. Taken internally, they operate with violence both upwards and downwards: The ancients ventured on

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STAVES-ACRE.

their internal uſe, and I have myſelf ſeen them given in Poland; but the practice is by no means to be followed. Even when applied externally, they have been productive of dangerous conſequences, of no leſs than the epilepſy. Simon Paulli and others obſerve that they have a ſtrangulatory quality: And profeſſor Schluſe relates, that his ſenſes were diſordered by chewing ſome of them for a toothach. Thus much is obvious to the taſte, that they have a nauſeous burning heat and acrimony, which reſides rather in the kernel than in the ſhell.

An ounce of the ſeeds reduced into powder, yielded with rectified ſpirit two ſcruples and five grains of reſinous extract: In this proceſs, a groſs Oil of the expreſſible kind, ſeparated, to the quantity of a dram and a half: The matter left by ſpirit, digeſted and boiled with water, gave two ſcruples four grains of gummy extract, near five drams remaining at laſt undiſſolved. Another ounce treated firſt with water, yielded one dram and thirty-five grains of gummy extract; and afterwards with ſpirit, one dram and eleven grains of groſs Oil, but no more than a ſingle grain of Reſin: The indiſſoluble reſiduum weighed five drams nine grains. As the watery extract retains great part of the Reſin, it proves conſiderably acrid, though far leſs ſo than the ſpirituous: The extract made by water after ſpirit has performed its office, diſcovers no acrimony. In diſtillation, ſpirit brings over nothing; the diſtilled water taſtes ſomewhat diſagreeably.

VII.
GRANA CNIDIA.

COCCOGNIDIUM or *Granum cnidium* is the berry of a ſhrub, growing wild in Germany in moiſt ſhady woods, called by an Arabic name *Mezereon*, and from its leaves bearing ſome reſemblance to thoſe of the Bay and of the Olive-trees, *Laureola* and *Chamelæa*. The ſpecies which produces the Coccognidia is named by Caſpar Bauhine *Laureola folio deciduo, flore purpureo, officinis Laureola femina.* The flowers come forth early in the ſpring before the leaves; they are ſmall, monopetalous, ſhaped ſomewhat like a funnel, of a pale purpliſh-red colour, and an agreeable ſmell, whilſt all the other parts of the plant are diſagreeable. The leaves, which follow the flowers, are

GRANA CNIDIA

ſoft, of a pale green colour, without any gloſſineſs. The ſtalks and branches are very flexible, covered with two barks; the outermoſt of which is of an aſh-colour, thin, and eaſily peeled off; the innermoſt green on the outſide, white within, very tough, and hard to tear ——The berries are at firſt green, afterwards red, and when ripe of a brown colour: They are much about the ſize, and partly of the appearance of Pepper-corns: They contain under the outward brown ſkin, another thin ſmooth one, commonly greeniſh and gloſſy; and under this a third, which looks as if coated with black varniſh: Under this lies the kernel, of a white colour, and about the ſize of a grain of Hempſeed.

The leaves and the bark were formerly uſed as purgatives, but have long been juſtly laid aſide on account of the violence of their operation: The correction of them by maceration in Vinegar or milk is inſignificant. The berries are in a high degree virulent: The kernels, applied externally, inflame and exulcerate the ſkin; chewed, they diſcover little taſte at firſt, but in a ſhort time begin to burn the mouth like a coal; ſwallowed, they occaſion immenſe vomitings and purgings, inflammations of the bowels, and even death. As experience has fully evinced their deleterious qualities, it is ſurpriſing that any medical writer ſhould recommend them; and yet we find both the berries in ſubſtance, and a watery extract made from them, directed as an evacuent in dropſies: Though the extract is more active than the berry itſelf, Herman recommends half a dram of it for a mild medicine.

With regard to the chemical compoſition of this fruit, it contains, beſides its cauſtic Reſin, and a gummy matter, a conſiderable portion of an expreſſible Oil. The Oil is of itſelf mild and inſipid as the other Oils of that claſs; but as theſe kinds of Oils are menſtrua for Reſins, it retains in moſt of the proceſſes, by which it is ſeparated, ſo much of the Reſin, or of its more ſubtile parts, as to prove highly acrimonious: Half a grain of the reſinous extract gives a fiery taſte to half an ounce of inſipid Oil. From four ounces of the berries I obtained by expreſſion half an ounce of

GRANA CNIDIA.

Oil, conſiderably acrid. An ounce of the berries, boiled with water, gave five ſcruples ſeventeen grains of extract; and five ſcruples and a half of a milder Oil, which ſeparated in the operation: The remainder, treated with ſpirit, gave two ſcruples of Reſin. Another ounce digeſted at firſt with ſpirit, yielded four ſcruples and eight grains of a reſinous maſs, after which water extracted two ſcruples thirteen grains of inſipid Mucilage.

It is obſervable, that though groſs Oils are not of themſelves ſoluble in Spirit of Wine, yet the Oil is here ſo intimately combined with the other principles, as to be extracted by the ſpirit, and remain uniformly mixed till great part of the menſtruum is evaporated; the groſſer Reſin then ſeparates and falls to the bottom, and the fluid Oil, ſtrongly impregnated with the more ſubtile cauſtic matter of the Reſin, floats on the ſurface.

VIII. COCCULUS INDUS.

COCCULUS INDUS is the berrry of an oriental plant, ſuppoſed to be a ſpecies of *Solanum*, and called by Ray *Solanum racemoſum Indicum*, &c. or Indian tree Nightſhade, producing its fruit in cluſters like grapes. The berries are brought to us from Alexandria and other parts of the Levant. They are partly about the ſize of Bay-berries, and partly of that of Chich-peas; roundiſh, but hollowed in a little towards the ſtalk, and approaching to a kidney ſhape, rough on the outſide, and of a grey-browniſh or blackiſh colour: The freſher they are, the heavier; the older, the dryer and lighter.

In their ſtructure, they greatly reſemble the Coccognidia, conſiſting of two ſhells and a kernel, in which laſt their activity reſides: The outer ſhell is thin, the inner thicker and whitiſh; the kernel is more manifeſtly of a kidney ſhape than the entire berry, when freſh of a white colour, but very apt to grow yellow and brown: It ſoon likewiſe becomes rancid, and is preyed on by worms, inſomuch that moſt of the berries, as we commonly meet with them, are found to be mere ſhells without any kernel.

Cocculus Indus.

The Cocculus Indus agrees alſo with Coccognidium in its deleterious purgative and emetic quality, though it does not diſcover ſuch a burning heat in the mouth, and impreſſes only a kind of bitterneſs. In Wepfer's treatiſe on the *Cicuta aquatica*, there are ſeveral obſervations of the effects of this berry on cats and dogs: Some died in a ſhort time, vehemently convulſed: Others, after ſuffering violent torments, recovered—Some recommend it to be held in the mouth for abating toothachs, or a mixture of it with one third its weight of Sal ammoniac to be put into the hollow tooth; but even this uſe of it is ſcarcely ſafe. It is principally employed in ointments for deſtroying cutaneous inſects, and in fiſhing. For this laſt purpoſe, a mixture of the powdered Cocculus with Rye-meal, old Cheeſe, Spirit of Wine and other ſubſtances, is formed into ſmall pellets or pills, which are uſed as a bait, or only thrown by themſelves into waters ſtocked with fiſh: The fiſhes by ſwallowing the pills, are ſtupefied and benumbed, ariſe to the ſurface, and may be eaſily caught by the hands.

The Cocculus Indus contains a groſs Oil like the Coccognidium, but in leſs quantity; the Oil does not ſeparate on treating the berry with water or ſpirit, but remains united with the etxracts, and renders the ſpirituous in particular quite unctuous. An ounce of Cocculus gave one dram of ſpirituous, and afterwards three drams of watery extract; four drams remaining undiſſolved. On inverting the order of applying the menſtrua, the quantity of the reſpective products was exactly the ſame, water extracting at firſt three drams, and ſpirit afterwards, one. The watery extract taſted ſtronger than the ſpirituous.

IX. Nux Vomica.

NUX VOMICA, ſo called, is not a nut, but the ſeed of a fruit like an Orange, growing in the Eaſt Indies: It is called by the Germans *Kræhenaugen*, Crows-eyes, from its having ſomewhat of the appearance of a grey eye, and from its being poiſonous to crows. The tree is deſcribed and figured in the *Hortus Malabaricus* under the name of *Caniram*. The ſeeds brought to us are of different ſizes, and pro-

Nux Vomica.

produced by different ſpecies of the plant: The tree which yields the ſmaller ſort is that whoſe roots are the *Lignum colubrinum* of the ſhops. They are commonly of a roundiſh flat figure variouſly bent, with a navel or prominence in the middle, covered all over with fine ſhort hairs like velvet: The kernel is nearly of the conſiſtence of horn, but harder and more brittle, ſo as to be beat in pieces by a hammer.

An ounce of Nux vomica, raſped into fine powder, yielded with water half an ounce of gummy extract, and afterwards with ſpirit only five grains of Reſin; another ounce, treated firſt with ſpirit, gave one dram thirty-two grains of reſinous extract, and afterwards two drams thirty-ſix grains of Mucilage; the indiſſoluble part amounting to about half the weight of the ſeed. Both the watery and ſpirituous extracts, prepared at firſt, are very bitter, particularly the ſpirituous: Thoſe made by either menſtruum, after the other has performed its office, have little bitterneſs. In diſtillation, neither water nor ſpirit bring over any thing remarkable. The watery ſpirit of Sal ammoniac digeſted on this ſeed, gains a deeper colour than any other menſtruum; the tincture is browniſh-red. The vinous Spirit of Sal-ammoniac ſcarce extracts a yellowiſh hue; and ſimple Spirit of Wine receives no tinge at all.

Nux vomica is poiſonous to dogs, to other carnivorous animals, and ſuch are born blind. It does not indeed follow from hence that it is poiſonous to men; and ſome have even recommended it as a notable diaphoretic and alexipharmic; and Melichius obſerves that it is eaten by the Turks without injury. But Seutter tells us of a woman in Holland, who on taking a doſe of Nux vomica, mixed with a little Gentian, for the cure of an intermitting fever, was thrown into violent convulſions, from which ſhe difficultly eſcaped with her life: This one example is ſufficient to deter us from the uſe of the Nux vomica, eſpecially as we are furniſhed with efficacious and unſuſpected medicines for all the intentions in which it is recommended. It is obſervable, that the

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NUX VOMICA. outer ſkin, and its hairy covering, are more virulent than the kernel.

X. IGNATUS's BEAN. ST. IGNATUS's BEAN, *Faba ſancti Ignatii, Faba febrifuga Bironis, Igaſur*, &c. is not a bean, but the ſeed of a fruit of the gourd kind. The beſt account of the plant that has yet appeared, is that ſent by Father Camelli to Ray and Petiver and publiſhed in the Philoſophical Tranſactions for the year 1699: He obſerves, that it grows in the Philippine Iſlands, and winds itſelf about the talleſt trees to the top; that it has large, ribbed, bitter leaves, a flower like that of the Pomegranate, and a fruit larger than a Melon. Some reſemble the fruit to a Pomegranate, probably from miſapplying Camelli's words. The fruit is covered with a thin, gloſſy, blackiſh-green, and as it were marbled ſhell, under which is lodged another of a ſtony hardneſs: Within this is contained a ſoft, yellow, bitteriſh pulp, in which lie the ſeeds or beans to the number commonly of twenty-four, each covered with a ſilvery down.

The ſame gentleman gives an account of the virtues attributed to theſe ſeeds by the Indians; but experience has ſhewn that they are dangerous. Konig relates that a perſon, by drinking ſome of a ſpirituous tincture of them inſtead of Aqua vitæ, was thrown into ſtrong convulſions; and Dr. Grim, that a dram of the ſeed in ſubſtance occaſioned, for a time, a total deprivation of the ſenſes. Others mention violent vomitings and purgings from its uſe. The only good effect I have myſelf obſerved from this ſeed is the removal of intermitting fevers by drinking, on the approach of a paroxyſm, an infuſion of ſome grains of the Bean made in Carduus water: We are not however from hence to look upon this medicine as an univerſal Febrifuge, or to uſe it indiſcriminately.

Theſe Beans (for ſo cuſtom requires that we ſhould call them) are about the ſize of a moderately large Nutmeg; in figure ſomewhat roundiſh, but extremely irregular, ſcarcely any two being entirely alike, full of unequal depreſſions and prominencies; in

IGNATUS' BEAN.

in colour, externally yellowiſh brown, but when the outer ſkin is taken off, of a blackiſh brown, and in part quite blackiſh; in conſiſtence hard and compact as horn, ſo as not to be reducible into a powdery form but by cutting or raſping: For all their hardneſs, however, they are not proof againſt worms. When freſh, they have ſomewhat of a muſky ſmell; which by age is loſt: Their taſte is very bitter, reſembling by ſome to that of Centaury.

Four drams of theſe Beans, boiled in water, gave juſt two drams of gummy extract: after which, rectified Spirit of Wine ſcarcely took up half a grain. Half an ounce, treated firſt with ſpirit, gave two ſcruples and a half of a gummy one. The ſpirituous extract made at firſt is of a yellowiſh colour, and the watery greeniſh. They are both bitter: The ſpirituous impreſſes at firſt a very agreeable bitterneſs, ſomewhat like that of Peach-kernels; which going off, leaves in the mouth a ſtrong bitter. The diſtilled liquors have no taſte or ſmell.

XI. WHITE HELLEBORE.

THE name HELLEBORE, ſuppoſed to be derived from ἑλεῖν βορᾷ to kill by-eating, is applied to different roſaceous-flowered plants. The white Hellebore is made by Tournefort a diſtinct genus from the black, under the name of *Veratrum*; its ſeed veſſels wanting the horns which thoſe of the other have, and its ſeeds being ſurrounded with a leafy margin, which thoſe of the other are not: He calls the officinal ſpecies *Veratrum flore ſubviridi*, greeniſh-flowered *Veratrum*, in diſtinction from another, whoſe flowers are of a blackiſh-red colour.

This plant grows wild in France, Switzerland, Auſtria and other countries, but is not a native of Germany. The root, which is the only part made uſe of, is oblong, an inch thick or more, of a blackiſh grey colour on the outſide and white within, ſurrounded with ſmall fibres, crooked and unequal, of a nauſeous, acrid, bitteriſh, aſtringent taſte, and no ſmell.

Two ounces of white Hellebore root yielded with Water nine drams and a ſcruple of gummy extract; and afterwards with Spirit, only half a ſcruple of Re-

WHITE HELLEBORE.

ſin. The ſame quantity, treated firſt with Spirit, yielded ſeven drams of reſinous, and afterwards with Water near three drams of gummy extract. Neither Water nor Spirit elevate any thing remarkable in diſtillation.

White Hellebore root is a violent emetic: Matthiolus reports, that the Spaniards prepare an actual poiſon from it. The reſinous preparations are particularly unſafe. A tincture made with Spirit of Wine from two ounces of Bryony-roots, two ounces of Sowbread-roots, and one ounce of white Hellebore-roots, was formerly in ſome eſteem as an emetic, under the title of *Vomitorium conradinum*: So great is the activity of this liquor, that the little which a feather takes up, not exceeding perhaps two drops, received in Wine, is a ſufficient doſe. This root has been ſuppoſed peculiarly ſerviceable in maniacal diſorders: Its violence however is ſo great, that it is moſt prudently refrained from: There are ſeveral inſtances in the *Ephemerides naturæ curioſorum* and other books, of its having proved fatal.

Its principal uſe is as a purge and vomit for cattle; in ointments againſt ſome kinds of cutaneous eruptions, and inſects; and as a ſternutatory. A red Sternutatory powder may be made by moiſtening, with a tincture of the Hellebore-root, powdered clove July-flowers, which may be ground with a little Almonds to improve the colour; a green one with powdered Betony leaves and a white with Creme of Tartar or Sugar.

XII.
BLACK HELLEBORE.

THE roots of BLACK HELLEBORE conſiſt of a number of ſlender black or browniſh-black fibres hanging from one head; the fibres, which are the part made uſe of, have nothing of the woody pith, which ſome direct us to ſearch for and throw away. The narrower leaved Black-hellebore with Roſe-coloured flowers is the ſpecies whoſe roots are generally underſtood as the officinal kind; thoſe of the larger-leaved ſort are little different; thoſe of the garden green-flowered Black Hellebore are inferior in quality to both the others, though among us (in Germany) moſt commonly made uſe of. All the three grow wild in ſeveral of the mountainous parts of Europe, as in Tyrol, Switzerland, Auſtria, England, &c.

BLACK HELLEBORE.

The roots of Aconite or Napellus greatly reſemble thoſe of Black-hellebore, and have ſometimes been miſtaken for them: Of the unhappy conſequences ariſing from this miſtake, there is an account in the Breſlaw collections for the year 1720. As the Aconite-roots incline more to a brown than a blackiſh colour, we ſhould be careful in purchaſing Hellebore, to chuſe the blackeſt: In this light, the firſt of the Hellebores above-mentioned is to be preferred, as its roots are blackeſt, and conſequently the moſt diſtinguiſhable from the poiſonous root.

Black-hellebore root has a nauſeous ſweetiſh taſte; which is followed by a bitter one that dwells long upon the tongue: It has no ſmell. No one has given any ſatisfactory chemical analyſis of it, but Monſ. Boulduc: The experiments, however, which that gentleman gave in to the French Academy were not made by himſelf, but by a German chemiſt, Dr. Groſſe. In my experiments, ſix ounces of the root, treated firſt with rectified ſpirit, gave ſix drams and a ſcruple of extract; after which, water extracted three drams one grain and a half: Water applied at firſt took up ſix drams two grains, and rectified ſpirit afterwards three drams one grain. Thus which ſoever menſtruum we apply at firſt, it extracts about ſix ſixteenths, leaving three ſixteenths which may be extracted by the other; about ſeven ſixteenths remaining unaffected by either.

The ſpirituous extract, whether made from the root directly, or from ſuch as has undergone the action of water, appears of a ſoft unctuous conſiſtence, this root containing a portion of groſs Oil, of the expreſſible kind; a principle, which eſcaped Boulduc's examination. The ſpirituous extract made at firſt, being digeſted in water, about three fourths of it were diſſolved, and the remaining fourth proved a quite thin oily-reſinous matter. Some report that the diſtilled water has a manifeſtly ſharp taſte. Borrichius relates, in his apology againſt Conringius, that a water diſtil-

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BLACK HELLEBORE. led from Black-hellebore in the heat of a water-bath, given to a boy to the quantity of eight ſpoonfuls, occaſioned gripes and motions to ſtool; and that a dog, by twelve ſpoonfulls, was four times vomited, and twice purged. This experiment deſerves to be further examined: The diſtillation ſeems to have been made from the entire plant.

The root in ſubſtance is a ſtrong ſtimulating cathartic, and in ſmaller doſes, a powerful aperient: Hence it is recommended in manaical, and melancholic and hypochondriacal diſorders, in quartan agues, in menſtrual and other obſtructions. The beſt preparation is a watery extract made by long boiling, which may be given from three to ſix grains made into pills with other ingredients: The ſpirituous extract is too violent.

XIII. AGARIC. AGARIC is a ſpongy fungous ſubſtance growing on the trunk of a tree, or in the language of the ancients, an excreſcence or apoſtem from age or diſeaſe. The tree is the common Larch, from which Turpentine is obtained. (See page 9.) It grows wild in Dauphiny, Savoy, on the Alps, in Auſtria, Tartary, &c. and is the only coniferous tree that ſheds its leaves in the winter: When it grows old, the fungus comes forth in ſeveral places on its trunk, and if the tree is large, on the firſt branches.

The fungus is of various ſizes, ſometimes not exceeding the bigneſs of the fiſt, ſometimes as large as a man's head: It takes at leaſt a year to grow to its full ſize. There are two kinds of it, called by the ancients *Mas* and *Femina.* The male Agaric is dark-coloured, hard, heavy and woody: It is ſeldom taken from the Larch, but chiefly from old Oak trees, and hence is called by ſome Agaric of the Oak: It is quite unfit for any medicinal uſe, and is only now and then employed by the dyers as an ingredient in the black dye. The female or officinal Agaric is covered with a hard blackiſh rind like the other; but when the cortical part is pared off, the internal ſubſtance appears quite white: By age, it changes a little yellowiſh. It ſhould be very light, porous, eaſy to break, free from any hard pieces or compact veins. Taſted, it proves at firſt ſweetiſh, but preſently becomes very bitter and nauſeous.

As Agaric is an excreſcence from a very reſinous tree, it is natural for it to be rich in Reſin. We find in effect that it contains three fourths its weight of reſinous matter, and that the remaining fourth is a ſlimy, mucilaginous, earthy ſubſtance, ſo tenacious as ſcarce to be by any means diſſolved or divided; continuing, however treated with water, a tough gluey paſte. The purgative quality of Agaric reſides in the Reſin: To the glutinous matter we may attribute the dangerous conſequences, which, when given in ſubſtance, however corrected, it is apt to produce. No wonder that ſuch a coheſive indiſſoluble ſubſtance ſhould adhere, pertinaciouſly to the ſtomach and inteſtines, and occaſion gripes and other inconveniences.

From eight ounces of very good Agaric, I obtained by rectified ſpirit, ſix ounces of reſinous extract: From the reſiduum only two drams and two ſcruples of watery extract: The indiſſoluble tenacious matter weighed two ounces one dram and a half; ſo that there was upon the whole an increaſe of near half an ounce above the original weight of the Agaric, from a part of the menſtrua retained. On applying water at firſt, I got but bare three drams of extract; on treating the remainder with ſpirit, I gained near as much Reſin as when ſpirit was uſed firſt, namely five ounces and ſeven drams; the indiſſoluble matter weighed, when dry, two ounces two drams.

In reducing agaric to powder, whether by the raſp or the peſtle, great care muſt be taken to avoid the fine duſt that flies off; which is not only apt to occaſion violent ſneezing, and inflammations of the eyes, but is likewiſe very prejudicial to the breaſt. Agaric cannot of itſelf be pulverized in a mortar, on account of its glutinous ſubſtance: The beſt way of obtaining a powder from it is, firſt to raſp, and then to make it into a paſte, with Mucilage of Gum Tragacanth: When this is thoroughly dry, great part of it may be beat into a fine powder, and by treating the remainder in the ſame manner, the whole will at length be got

AGARIC. through the ſieve. It might be ſuppoſed, that as it is the mucilaginous part of Agaric itſelf that prevents its pulverization, the addition of freſh Mucilage would do more harm than good; but the Mucilage of Gum Tragacanth is of a quite different nature from that of Agaric, being ſoluble, harmleſs when dry, brittle, and rendering the Agaric alſo brittle and pulverable along with it. The troches of Agaric, a preparation formerly in eſteem, and ſtill retained in many diſpenſatories, are likewiſe moſt commodiouſly made up with this addition: When formed with only an infuſion of Ginger and Wine, as directed by the ancients, they do not dry; Nor does Zwelfer's method, of making them up in froſty weather, ſucceed: A ſtrong froſt will indeed freeze them, but when the froſt is gone, they thaw into a pap again. In ſome diſpenſatories, a reſinous extract is directed to be prepared from this fungus by rectified ſpirit. An extraction may be made from it, of which a ſingle drop is capable of exciting vomiting (*d*).

XIV. COLOCYNTH. COLOCYNTH or Coloqintida is the fruit of a plant of the Gourd kind, growing plentifully in Perſia, differing from other Gourds in the leaves, being deeply cut in, but more remarkably in the quality of the fruit, which is ſo intenſely bitter as to have received the names of Gall of the Earth, Bitter Apple, Devil's Apple, &c. The medullary fungous part of the fruit, freed from the rind, is brought to us from Egypt and Aleppo.

Mr. Boulduc has given ſome experiments on Colocynth, with which mine do not entirely agree. He aſſures us, that on fermenting it with Muſt, and then diſtilling the liquor, he obtained a bitter purgative ſpirit: I repeated the proceſs, uſing only Wine and Sugar inſtead of Muſt, which could not make any ma-

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(*d*) *One drop let fall on the tongue, occaſions vomiting, and a diſguſt to food for a whole day.*] This is reported by Boulduc, of a ſpirituous tincture made from the cortical part of Agaric; and from him our author ſeems to have borrowed the obſervation. I have not found that the ſtrongeſt tinctures of the common Agaric of the ſhops produce any ſuch effect: To the taſte they are remarkably ſweet, and their ſweetneſs is very durable in the mouth, but becomes unpleaſant, though in no very great degree, before it goes off.

COLOCYNTH.

terial difference; but without finding that the diſtilled ſpirit had the leaſt bitterneſs or purgative quality. Boulduc obtained from a pound of the pulp, only an ounce of ſpirituous extract, and from another pound only two ounces and an half of watery extract; whereas in my experiments, the ſpirituous extract amounted to three ounces and an half, and the watery to ſeven and a half. When ſpirit was applied at firſt, I gained from the remainder four ounces and a half of watery extract; and when water was firſt applied, the reſiduum yielded three drams forty-four grains to ſpirit.

The ſeeds differ remarkably from the pulp; whilſt the latter gives out half its weight of gummy and reſinous matter, the former yield but one eighth, nor is there much difference in the quantity of extracts, whether water or ſpirit are uſed firſt, the ſpirituous amounting only to eight ſcruples on the pound more than the watery. The ſpirituous extract of the ſeeds is manifeſtly unctuous or oily, though I could not ſeparate any Oil by expreſſion on committing ſeveral pounds to the operation at once. All the extracts made from the pulp are much bitterer than thoſe from the ſeeds, the firſt extracts bitterer than the ſecond, and the diſtilled liquors, both watery and ſpirituous, inſipid and inodorous.

The pulp of Colocynth is a violent purgative, apt to bring on convulſions and inflammations of the bowels. Many attempts have been made to correct it, by alcalies both fixed and volatile, vegetable acids, neutral ſalts, aromatics, &c. but the moſt prudent way is to refrain from it altogether; or to uſe only a watery extract made by long boiling: By long boiling with water, all the draſtic vegetables loſe their virulence and become mild.

XV. **BRYONY.**

THERE are two ſorts of BRYONY, one bearing red, the other black berries: The firſt is the moſt common about Berlin, climbing upon hedges, trees, old walls, &c. The roots of both ſorts are alike both in quality and appearance: They are moderately large, often forked, ſo as to be reſembled to the human

BRYONY. body, and are by ſome cut into various figures and put off for mandrakes: They are externally of a yellowiſh colour, internally white and porous, of a bitteriſh, acrid, aſtringent taſte, and a diſagreeable ſmell, which is in great meaſure loſt by drying.

Bryony-root is a ſtrong purgative, and as ſuch has been recommended in hydropic caſes: It appears however not to be entirely ſafe. Mechoacan, an American root whoſe uſe had long been ſuperſeded by Rhubarb, was again had recourſe to in Germany ſome years ago, on the failure of Rhubarb from wars in Perſia: Mechoacan thus grew ſcarce, but preſently the ſhops were ſtocked, in leſs time than they could be ſuppoſed to have received ſupplies from America; and the roots looked alſo quite freſh, and different from what Mechoacan uſed to be. Theſe roots were probably Bryony, which in appearance does not ill reſemble Mechoacan. They were often productive of dangerous, and even fatal ſymptoms: In a few minutes after taking them, convulſions, a deprivation of the ſenſes, ſwelling of the eyes and head, frequently ſucceeded, not only in children, but in adults of the ſtrongeſt conſtitution. Platerus probably had experienced ſome ill effects from Bryony-root, or he would not have taken the trouble of drying and infuſing it ſo often in Wine, to fit it for medicinal uſe.

Boulduc relates, in the French Memoirs, that this root contains only ſaline principles, and no Reſin. In my experiments a true Reſin was gained from it, but no ſalt could be ſeparated, though it doubtleſs does contain a portion of ſaline matter, as the juice, added to a ſolution of Sulphur made with Quick-lime, occaſions a precipitation, accompanied with a fetid ſmell. It precipitates alſo a ſolution of ſublimate, and in ſome degree that of blue Vitriol; but theſe precipitations are no mark of a Salt, and proceed from the feculent part of the juice.

A pound of the freſh roots yield near ſix ounces of juice, which retains much of the ill ſmell and taſte of the root: On ſtanding, it depoſites a white powdery matter, called *fecula* of Bryony, and recommended as

a milder

Bryony. a milder purgative than the root in ſubſtance. Two ounces of the dry root yielded with Water ten drams ſix grains of gummy extract, and afterwards with Spirit twenty-three grains of Reſin; five drams thirty-two grains remaining undiſſolved. It is pretty remarkable, that the reſiduum was in larger quantity when Spirit was applied firſt: By this method of application, I obtained, from two ounces, of reſinous extract two drams two ſcruples and a half; and afterwards four drams one ſcruple of a gummy one; eight drams two ſcruples and ſix grains remaining.

XVI. Jalap. Jalap is the root of a ſpecies of convolvulus, with leaves like thoſe of Ivy, but not ſo thick, and beautiful red flowers, which have this remarkably property, that they open in the night, and ſhut again on the leaſt appearance of the ſun; whence the plant is called by the French *Belle de nuit*, the beauty or fair one of the night: In rainy or cloudy days, the flowers open a little, but fall off the ſooner, as if day-light was injurious to them. The Jalap-plant is a native of the province Chalapa or Xalapa in New Spain, from whence its name is derived, and written, according to the pronunciation of different languages, *Jalapa* or *Jalapium*, *Gialappa*, *Chalapa*, *Xalapa*, *Zalapa*, &c. The roots raiſed in Europe have been found much weaker than the American.

Jalap is brought over in thin ſlices; of which the beſt are compact and hard, ſo as not to be broke by the fingers, ponderous, of a dark brown colour, of a gloſſy reſinous appearance, or at leaſt furniſhed with reſinous ſtreaks and circles, eaſily inflammable, of no ſmell, or a faint unpleaſant one, and of a ſlight acrid taſte: The fine duſt which flies off in powdering them, provokes ſneezing. Thoſe which are thoroughly reſinous, are not liable to be worm eaten, the worms preying chiefly upon the gummy or mucilaginous parts, and not touching the reſin, or at leaſt not till theſe are conſumed: Hence we may ſuppoſe the worm eaten roots to have been originally of a bad kind, produced in moiſt ſoils or rainy ſeaſons, &c. and hence the worm eaten may be employed for making extracts

JALAP. equally with any other, the Reſin being equal in goodneſs, though leſs in quantity.

From ſixteen ounces of good Jalap-root I obtained, by Spirit of Wine, five ounces and four ſcruples of reſinous extract, and afterwards by Water two ounces and a half of a gummy one: On applying Water at firſt I gained four ounces and a half of gummy extract, together with ſix drams of a reſinous matter which fell to the bottom in evaporating the decoction; the remainder yielded, with Spirit, three ounces of Reſin: The indiſſoluble part amounted in the firſt caſe to eight ounces three drams, in the latter to ſeven ounces ſix drams. By precipitating a ſpirituous tincture of the root with Water, I gained, from a pound, four ounces of pure Reſin.

The inferior ſorts of Jalap yield leſs reſinous and more gummy extract: Such muſt have been that employed by Boulduc, who obtained, from ſixteen ounces, only two ounces five drams and a ſcruple of reſinous extract, but upwards of eight ounces and a half of a gummy one.

Jalap is a moderately ſtrong, but a ſafe purgative, and wants none of the correctors which officious induſtry has contrived for it. It is given in doſes of a ſcruple, with the addition of an equal quantity of vitriolated Tartar, and a few drops of Oil of Aniſeeds. The pure Reſin indeed is not to be ventured on without a corrector, as it gripes violently; but the proper correction does not conſiſt in leſſening its power, but in dividing and rendering it ſoluble in the animal fluids: For this purpoſe nothing anſwers better than grinding it with almons, pine-nuts, yolk of eggs or other like ſubſtances, into the form of an emulſion. With regard to the different preparations of this root a ſolution of Sugar or other ſubſtances that may prevent its ſeparation, purges much more powerfully than the Reſin given in a ſolid form however divided. A watery extract made from Jalap, after the action of ſpirit, promotes urine but ſcarce proves at all purgative: This preparation was uſed by Borellus as an arcanum in dropſies. The watery extract made at firſt is

JALAP.

is both diuretic and weakly purgative. A compound extract made by Water and Spirit together, contains all the ſoluble parts of the root, and operates powerfully both by urine and ſtool.

It is obſervable of this root, that it has a notable degree of fermentative power; exciting this action in groſs ſweet vegetable juices, as melaſſes, and at the ſame time impregnating them with its purgative quality.

XVII. MATTALIST.

SOME years ago another purging root was brought from America under the name of MATTALISTA, of which, in Holland, there are two ſorts, a coarſer and a finer: One is ſaid to be the produce chiefly of the French Weſt Indies; the other of New Spain, and Aquacathan in New Gallicia. It is called in America *Battata da purga.* The plant is as yet unknown. The only botaniſt I know of, that makes any mention of it, is John Bauhine, who calls it *Radix purgativa indica.* This root is chiefly recommended as a purgative in bilious complaints: It is nearly of a middle ſtrength betwixt Jalap and Mechoacan, being weaker than the firſt and ſtronger than the laſt. It yields a Reſin ſimiliar to that of Jalap, but in leſs quantity; only ten drams, or an ounce and a half at moſt, being obtainable from ſixteen ounces of Mattaliſta.

XVIII. TURBITH

TURBITH is the root of a large convolvulus, growing in moiſt places near the ſea coaſts, in the iſland Ceylon, Suratte, Malabar, Goa, but moſt plentifully in Guzarotta, from whence the greateſt quantities of the roots are brought into Europe. The root is commonly about the thickneſs of the finger, though ſometimes twice or thrice as thick, browniſh on the outſide, whitiſh within, with a white ſpongy woody pith: Its taſte is at firſt ſweetiſh, afterwards acrid and diſagreeable.

The Indians formerly ſlit the roots longitudinally, and took out the woody matter. At preſent the roots are generally brought over pith and all, being only cut tranſverſely into oblong pieces, which are often found to be ſcorched at the ends: The uſe of the ſcorching is to ſear up the divided veſſels, and prevent the oozing out of the reſinous yellowiſh juice, with

TURBITH. which the freſh roots abound. Albinus's ſuſpicion, that this juice is deſignedly extracted from them, before they come to us, appears to be groundleſs.

Sixteen ounces of Turbith root yielded with Water ſeven ounces three drams of gummy extract, and afterwards with Spirit only five drams forty five grains of Reſin: Another pound treated firſt with reictified Spirit, gave two ounces of reſinous; and afterwards with Water, ſix ounces, eight ſcruples of gummy extract. The indiſſoluble earthy part amounts in both caſes to ſomewhat more than half the weight of the Turbith: Its quantity is ſomewhat greater when Spirit, than when Water is applied firſt—— Water diſtilled from Turbith diſcovers a nauſeous ſmell and taſte but no Oil.

Turbith root is a moderately ſtrong purgative: As ſuch the root in ſubſtance was formerly given, from a ſcruple to half a dram, and the Reſin to half a ſcruple; but ſince the introduction of Jalap, Turbith has been rarely uſed.

XIX. HERMODAC. HERMODACTYL is a root of the ſhape of a heart flatted; not at all of the ſhape of a finger, which its name ſeems to imply. It comes chiefly from Aleppo and Smyrna by the way of Venice. The plant is wholly unknown: For the ſpecies of *Iris* given by Tournefort and Boerhaave, and the *Colchicum* by others, for the true Hermodactyl plant, have roots, according to their own account, entirely different from the officinal Hermodactyl.

We meet with Hermodactyls of various colours and ſizes, white, reddiſh, yellowiſh, browniſh, ſmall and large, wrinkled and ſmooth: The beſt are white both externally and internall, ſolid and compact, yet eaſily reducible into a powder, which looks like Wheat-flour, and does not grealy differ in taſte. This root is generally held a purgative, by ſome a ſtrong one: It does not appear, however to have any activity at all. Hermann juſtly obſerves that when dry, it is entirely if not altogether inert: But on what foundation he aſſerts that it is purgative when freſh, I know not, for he certainly never ſaw the freſh roots.

The

HERMODAC

The chemical compoſition of this root is pretty extraordinary. Two ounces of Hermodactyls, cut ſmall, yielded with rectified Spirit a dram and a half of reſinous extract, and afterwards with Water an ounce of gummy extract; ſix drams and a half remaining undiſſolved. If we invert the order, and apply Water at firſt, inſtead of an ounce of gummy extract, we obtain but half an ounce and three grains, and yet the reſiduum gives out nothing to rectified Spirit how long ſoever the digeſtion is continued: this reſiduum weighs one ounce and a half, and does not look near ſo dark coloured as that from which more has been extracted, but ſemitranſparent, almoſt like horn. Theſe remarkable differences in the effects of Water and Spirit, according as either is applied firſt to the root, may deſerve further enquiry.

CLASS III.

Gummy-Reſinous Vegetables.

GUMMY RESINOUS.

GUMMY-Reſinous ſubſtances are thoſe, whoſe medicinal activity or colour reſide in ſuch a combination of reſinous and gummy matter, as to be extracted by Water, ſometimes more perfectly than by Spirit, and not only by boiling but by infuſion in Water. Moſt of the bodies of this claſs, after repeated infuſion in water, yield ſtill a portion of reſinous matter to rectified Spirit: But the Reſin thus obtained has generally little or nothing [illegible] diſtinguiſhing taſte or virtue of the ſubject. To this diviſion belong ſome of the emetics, as Tobacco, Aſarum, Ipecacoanha, Arnica; a few of the purgatives, as Sena Rhubarb, Rhapontic; moſt of the aſtringents, as Tormentil and Galls; moſt of the bitters, as Gentian, Centaury, Carduus; ſome of the colouring drugs, as Turmeric; with many others of weaker or more compounded qualities.

I. TOBACCO.

TOBACCO (*Petum, Nicotiana, Herba medicea, &c.*) was firſt diſcovered in the iſland *Tobago*; brought into Europe, in the year 1559 or 1560, by M. *Nicot* the French ambaſſador in Portugal; and preſented to Queen Catherine *de Medicis*. It is now become the ob-

TOBACCO. object of very extenſive manufactures, and cultivated in large quantity by the European colonies in America, as alſo in ſome parts of Europe. There are different ſpecies of the plant, and great differences alſo in the qualities of one ſpecies according to the ſoil and climate: Still further differences are occaſioned in the prepared Tobaccos and Snuffs, from the manner of preparation, and the additions made uſe of for communicating colour, flavour, &c.

The leaves of this plant, taken internally, prove virulently emetic, cathartic, and narcotic: Even in the common forms in which they are employed in ſuch immenſe quantities, they generally at firſt diſorder the conſtitution, till habitual uſe, which ſubdues many noxious things, has rendered them perhaps innocent, and perhaps even neceſſary. Diſtilled in a retort without addition, they yield an acrid empyreumatic Oil, which has been found, from repeated trials, to be poiſonous to ſundry animals: It is probably on this oil that the effects of the ſmoke of Tobacco depend, for when the plant is ſet on fire, its native qualities are deſtroyed.

Tobacco loſes its virulence by long coction in Water: though all the active parts of the Herb are extracted by the water, yet the extract left upon evaporating the liquor, taken in doſes of four or five grains, proves mildly aperient and anodyne, and is ſaid to be of great ſervice in diſorders of the breaſt: The longer the coction is continued, a ſuitable quantity of Water being added for that purpoſe, the milder is the extract.

I analyſed three ſorts of Tobacco, the American caniſter Tobacco, the Dutch leaf, and the dried leaves of our own growth. An ounce of the caniſter, treated firſt with Water, gave four drams thirty grains of extract; the ſame quantity of the Dutch, four drams; of our own four drams fifty grains: From the reſiduum of the firſt, rectified Spirit extracted thirty grains; from that of the ſecond, ſixty; and from that of the third, thirty.——An ounce of the caniſter ſort, treated firſt with rectified Spirit, yielded one dram thirty grains; the ſame quantity of the Dutch, two drams

Tobacco.

twenty grains; and an ounce of ours, two drams thirty grains: From the reſiduum of the firſt, Water extracted three drams thirty grains; from that of the ſecond, two drams forty grains; of the third, two drams thirty grains: The indiſſoluble earthy matter amounted, in each of the experiments, to three drams.

The ſpirituous extracts, made from all the ſorts, were ſtronger than the watery: That of the caniſter ſort was notably pungent on the tongue; of the Dutch, only bitteriſh, without any acrimony; the ſpirituous extract of ours taſted ſomewhat pungent, but the watery only bitter. The ſpirituous extracts of all the ſorts are of a fine green colour, the watery of a yellowiſh brown. The diſtilled Waters and Spirits have no taſte or ſmell: Bohn, however, pretends that the diſtilled Water, eſpecially if drawn from the juice of the herb, will occaſion vomiting if taken to the quantity of an ounce or two.

II. Arnica.

ARNICA, *Arnica plauenſis*, is a ſpecies of Doronicum, (*Doronicum plantaginis folio alterum, C. B.*) with leaves like thoſe of Plantane, and yellow radiated flowers. The flowers and leaves are emetic or purgative: An infuſion of them is ſaid to be remarkably ſerviceable for reſolving coagulated blood from falls, *&c.* and in obſtructions of different kinds: See the *Acta Berolinenſia*, the Breſlaw Collections, and the Diſſertations of Albertus and Buchner on this plant.

Two ounces of the flowers yielded with rectified Spirit three drams of extract; the ſame quantity of the leaves only two and a half: With Water, the leaves afforded moſt, two ounces giving five drams and a half, whilſt the ſame quantity of the flowers gave but five drams. The watery extract appears to be the mildeſt, and oftentimes does not occaſion either vomiting or nauſea. Neither the leaves nor flowers have any remarkable ſmell, or give over any thing in diſtillation.

III. Ipecaco.

IPECACOANHA, called by ſome, from its medical virtue, and the place of its growth, the American or Peruvian antidyſenteric, and Brazilian root, is the root of a plant ranked by Ray as a ſpecies of

IPECACO. Herb-paris, and diſtinguiſhed by the name of Brazilian Herb-paris bearing a number of berries.

There are four ſorts of Ipecacoanha; grey, brown, white, and yellow. The two firſt are thoſe which are moſt common in the ſhops: The third is rarely brought into Europe; and the fourth is mentioned only by Sherard, as received in a preſent from Tournefort. With regard to the two laſt I ſhall obſerve only, that the yellow is merely purgative, and does not, like the others, occaſion any vomiting: and that the white vomits more mildly than the grey or the brown.

Of the grey and brown, ſome prefer the one, and others the other; in England they are uſed promiſcuouſly. It is in general ſuppoſed, that the grey operates with greateſt mildneſs: This however depends, not upon the root being the grey or the brown ſort, but on its being good of the kind; I have ſeen very good and very bad Ipecacoanha of both ſorts.

Both the brown and the grey agree in their external figure, being about the thickneſs of a quill, very unequal and knotty: They have a bitteriſh ſomewhat acrid taſte, but diſcover little or no ſmell when the quantity examined is ſmall: In large quantity, they yield a diſagreeable ſmell, and in pulverization a kind of muſty one. The larger compact roots, of a reſinous appearance, are the beſt: The ſlender, blackiſh brown, and thoſe which are full of fibres, the worſt. There grows in America another plant, called there *Caapia*, whoſe roots greatly reſemble Ipecacoanha, and are frequently brought over in its ſtead: This root is externally of a yellowiſh colour: it is greatly inferior in virtue to the true Ipecacoanha, and therefore to be guarded againſt.

Boulduc relates, that the brown Ipecacuánha does not contain ſo much ſoluble matter as the grey: Probably the brown he employed was of a bad kind, for I have not obſerved any ſuch difference: Differences indeed there are, and great ones, but they depend wholly, as already mentioned, on the root being good or bad of the ſort. Sixteen ounces of good Ipecacoanha

IPECACO-

anha yielded with ſpirit three ounces of reſinous, and afterwards with water four ounces wanting two ſcruples of watery extract, eight ounces and ſix drams remaining undiſſolved. Another pound of the ſame, treated firſt with water, gave five ounces of gummy, and afterwards with ſpirit ten drams of reſinous extract; the indiſſoluble part amounting to two ſcruples more than in the former experiment—On the other hand, a pound of very bad Ipecacoanha yielded only an ounce and a half of reſinous, and the ſame quantity of gummy extract; and on inverting the order of applying the reſpective menſtrua, two ounces ſix drams of gummy, and only a dram and a half of reſinous extract.

Ipecacoanha is one of the mildeſt and ſafeſt emetics. Its firſt introduction into Europe was in the time of Louis XIV of France, by one Grenier, a French merchant, who brought an hundred and fifty pounds from Spain, of which trials were made in the Hotel-dieu. Helvetius firſt diſcovered, to his Moſt Chriſtian Majeſty, its antidyſenteric virtues, for which he received a reward of a thouſand louis-d'ors; as he informs us himſelf in his Treatiſe of Diſeaſes and Specific Remedies. Experience has ſince ſhewn that it is often of great ſervice in dyſenteries, but not always. The French phyſicians give it in ſmall doſes, frequently repeated; if it produces no amendment by the time that three drams have been taken, they deſiſt from any further uſe of it. They employ it ſometimes in the form of glyſter, but find that when thus managed, it does not anſwer ſo well as when ſwallowed.

Some have ſuppoſed that the emetic virtue of Ipecacoanha reſides in its gummy parts, the cathartic in its reſinous, and the aſtringent in its earthy. Thus much is certain that neither the gummy nor the reſinous parts ſeparately or conjointly, are equally ſerviceable in dyſenteries with the root in ſubſtance, and that infuſions of it in Wine are effectually emetic.

IV.
ASARUM.

THE roots of ASARUM ſeem to be nearly allied to Ipecacoanha. Though violently purgative and emetic when freſh, yet by keeping for three or four years, Asarum. and even by bare drying, they become far milder, ſcarcely vomiting or purging at all, but proving powerfully reſolvent. An extract made from them by long boiling with water, loſes entirely the purgative virtue of the root, and becomes reſolvent, diaphoretic, and diuretic. Aſarum roots agree likewiſe with Ipecacoanha in their chemical analyſis.

V. Sena. SENA is a ſmall ſhrub, with ſharp-pointed leaves ſomewhat like thoſe of Liquorice, roſaceous flowers, and flat-hooked pods or ſeedveſſels: It grows chiefly in Syria, Perſia, Arabia, and Egypt: The leaves and pods are brought to us immediately from Alexandria, whence the name *Sena Alexandrina.* A ſpecies of Sena is found alſo in Italy, but much inferior in virtue to the oriental: The leaves of this are readily diſtinguiſhed from thoſe of the other, by their being not pointed but broad at the end almoſt in ſhape of a heart. Pomet mentions three ſorts of the foreign Sena; the firſt or beſt is called *Sene d' Alexandrie*, or *Sene de la Palte*, that is Tribute-ſena, the Turks paying their tribute in this beſt ſort; the two others are *Sene de Seyde* or *de Tripoli*, and *de Moca*. They are all the produce of one ſpecies of plant, differing only according to the ſoil and climate. The beſt Sena leaves are of a fine green colour, free from ſpecks, ſmooth and ſoftiſh to the touch, and thoroughly dry, of a conſiderable degree of ſmell, and a bitteriſh ſomewhat nauſeous taſte. They are often expreſſed in preſcriptions [in Germany, *&c.*] by the letters *S. S. S.* i e. *Sena Sine Stipitibus*, Sena picked from the ſtalks.

Sena is one of the mildeſt purgatives. Its common doſe is two drams, infuſed in water: It is rarely given in ſubſtance, on account of its bulkineſs. The inconveniencies complained of in this medicine are, that it is apt to occaſion a nauſea, ſickneſs and flatulencies: which ſome erroneouſly aſcribe to the ſtalks and pods. The beſt correctors are the ſtarry-headed Aniſeeds, Cinnamon, Cloves, and Creme of Tartar. Mr. Marchand relates, in the French Memoirs for the year 1701, that the dry leaves of the greater Water-figwort (*Scrophularia aquatica, major, C. B.*) wholly take off its ill ſmell and taſte, equally with the *Iquetaya* celebrated for that purpoſe by the Brazilians. SENA.

An ounce of choice Sena, treated with freſh parcels of rectified Spirit of Wine, yielded two drams twenty-three grains of reſinous extract; and afterwards with water, two drams two ſcruples of gummy extract, three drams and three grains remaining undiſſolved. Another ounce, treated firſt with water, gave four drams and half a ſcruple of gummy, and afterwards with ſpirit only twenty-eight grains of a reſinous extract, which appeared to contain ſome groſs oily matter, and hence was difficultly reduced to dryneſs; the reſiduum weighed three drams and a ſcruple. Valentini muſt have operated very incuriouſly in obtaining but two ounces of extract from a pound: I gained near ten, reckoning the watery and ſpirituous together; and above eight of watery extract alone.

In diſtillation rectified ſpirit brings over nothing; the diſtilled water is impregnated with the ſmell of the Sena, but diſcovers no appearance of eſſential Oil. The activity of the Sena is greatly weakened by evaporation, eſpecially if the proceſs is performed by a boiling heat in an open veſſel, the extract proving far leſs purgative than an equivalent quantity of the infuſion which it was made from. The reſinous extract is more ungrateful in taſte than the watery, and contains the green colour of the leaf.

VI. RHUBARB. RHUBARB, *Rheum, Rhabarbarum*, (ſuppoſed to have been ſo called from its growing on the banks of the river *Rha*, now Wolga, in the *barbarous* country Ruſſia) is at preſent brought only from China: Part comes by land through Ruſſia, and part by ſea from the Eaſt-Indies. It is the root of a plant which agrees with the Docks in all its botanic characters but the flowers: thoſe of the Docks conſiſting merely of threads or ſtamina, whilſt thoſe of the Rhubarb plant are furniſhed each with a ſingle petalum ſhaped like a bell and divided into ſeveral ſegments about the

RHU-BARB.

the edges. The root is large, ſometimes oblong and ſometimes roundiſh, of a dark-browniſh colour on the outſide with black and reddiſh ſtreaks, internally reddiſh-yellow and full of a juice of the ſame colour. It is cured by cutting off the ſmall fibres and the dark-coloured cortical part, not all at once but at intervals, the ſide which is firſt pared being laid uppermoſt till the juice dries and concretes, afterwards boring a hole through the root, and hanging it up in a ſhady place till thoroughly dry.

This root is exceeding ſubject to ſpoil, and to be preyed upon by worms, unleſs kept perfectly dry. The dealers frequently fill up the wormholes with a maſs compoſed of powdered Rhubarb and Mucilage of Gum Tragacanth, and colour the old decayed roots with an infuſion of Rhubarb, Turmeric, or other colouring drugs. When Rhubarb looks very freſh and fair externally, or of a high yellow colour, we may ſuſpect that it has ſuffered theſe abuſes. Good Rhubarb is not of an uniform yellow, but variegated with browniſh and blackiſh ſpecks, veins, and circles: Internally it is reddiſh, ſtreaked and marbled as it were like a Nutmeg: It is of a ſpongy texture, yet moderately heavy, firm, and not eaſy to break: It readily ſtains the moiſt hand, and tinges the ſpittle on being chewed, of a deep yellow: Its ſmell is unpleaſant, its taſte is diſagreeably bitteriſh: The roots of middling ſize are better than the very ſmall or the very large ones: Some prefer the Ruſſia or Turkey, and ſome the Eaſt-India Rhubarb, but both ſorts, if equally well cured and preſerved, are of equal goodneſs (*e*).

An

(*e*) *Rhubarb---both ſorts equal in goodneſs.*] There are ſome differences in the qualities of the two ſorts of Rhubarb: Perhaps one may be beſt adapted for ſome purpoſes, and the other for others. The Eaſt India Rhubarb appears manifeſtly the ſtrongeſt, and the Turkey ſort has moſt of an aromatic flavour. Tinctures drawn from both, with equal quantities of rectified Spirit of Wine, have nearly the ſame taſte; but on drawing off the menſtruum, the extract left from the tincture of the Eaſt-India ſort proves conſiderably the ſtrongeſt. The Eaſt-India Rhubarb is more ſolid and compact than the other, and ſeems to have been taken up at a ſeaſon when the root is leſs watery: It does not appear to have

RHUBARB.

An ounce of fine Rhubarb, reduced into groſs powder, yielded with highly rectified Spirit of Wine three drams of extract, and afterwards with water three drams wanting half a ſcruple; the reſiduum weighed two drams twelve grains. On applying water at firſt to another ounce of the ſame, I obtained about as much extract as had been gained in the former caſe by the water and ſpirit both, namely ſix drams all but half a ſcruple; the reſiduum gave out five grains to rectified ſpirit, two drams eight grains remaining undiſſolved.

Thus we find that water extracts nearly all the ſoluble part of Rhubarb, but ſpirit little more than one half of it; a proof that this root contains a much larger proportion of gummy or mucilaginous than of reſinous matter: Hence ſpirituous tinctures of it are not precipitated or rendered milky by the addition of water, like the tinctures of moſt other vegetables. I examined alſo the ſolubility of the aqueous and ſpirituous extracts, each in its oppoſite menſtruum; out of ſixty grains of the ſpirituous extract, water diſſolved fifty five, but out of the ſame quantity of the watery, rectified ſpirit diſſolved only eighteen.

The yellow colour of Rhubarb is remarkably leſs deſtructible than many other vegetable yellows: Aqua fortis and other acids, which deſtroy the colour of infuſions of Saffron, Turmeric, &c. make no change in that of Rhubarb, or at moſt render it only turbid: Volatile ſpirits heighten the colour, and incline it to red; fixed alcaline Salts have this effect in a greater degree. Solutions of green vitriol, and other Chalybeate liquors, change infuſions of Rhubarb to an inky blackneſs; a mark that this root is poſſeſſed of an aſtringent quality.

In effect Rhubarb uſed as a medicine diſcovers, beſides its mild purgative virtue, a manifeſt aſtrin-

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have required ſo much care in the drying, as the pieces never have a hole through them like thoſe of the others: From its greater ſolidity, it is leſs ſubject to decay in keeping.

The Rhubarb plant has of late been naturalized to our own climate; But trials have not yet been made, how far the roots raiſed among us, agree or diſagree in quality with thoſe of foreign growth.

RHUBARB.

gency; whence its uſe in laxities and debilities of the viſcera, and in alvine fluxes. The powdered root acts much more effectually as a cathartic than infuſions, tinctures, extracts or other preparations: It may be taken to the quantity of a dram.

It is ſingular of this root, that the ſpirituous extract does not purge, but that the extract made by water after ſpirit does; as if its purgative quality reſided chiefly in a combination of gummy and ſaline matter. Mr. Boulduc relates that twenty-four grains of the powder purge as much as an infuſion of an hundred and eight grains, and as much as ſeventy-two grains of the watery extract; its purgative principle not being eaſily taken up by water any more than by ſpirit, and being in great part changed or deprived of its virtue during the evaporation. It ſeems as if this principle was in part volatile: Herman obſerves that in ſome perſons, the bare ſmell of Rhubarb opens the belly; and Borrichius, that even the diſtilled water is not only of a nauſeous taſte, but purgative.

Some endeavour to improve the virtue of Rhubarb for particular purpoſes, by torrefaction: The powdered root is placed on an iron plate, over a gentle fire, and kept continually ſtirring with an iron ſpatula, till it loſes its peculiar ſmell, and changes its yellow colour to a brown. By this means its purgative quality is greatly diminiſhed, and its aſtringent one ſuppoſed to be increaſed: The preparation however is at beſt an injudicious one, as all that can be expected from it may be obtained with greater certainty, by joining to Rhubarb a due proportion of ſome aſtringent or corroborant of known efficacy, as Peruvian bark or Caſcarilla. It is obſervable of this root, that it tinges the urine of a deep yellow or reddiſh colour.

VII. MONKS RHUBARB.

THE roots of certain Docks and ſome other plants raiſed in Europe approach to Rhubarb in appearance, participate in ſome degree of its medicinal virtues, and are ranked among the officinal ſimples, under the names of MONKS RHUBARB and RHAPON-

TIC. The common Monks Rhubarb is the root of the *Lapathum hortenſe latifolium, C. B.* broad-leaved garden Dock or Patience (*f*). The Rhapontic of the phyſick garden of Berlin, and which of all the ſorts comes the neareſt to the true Rhubarb, is the *Lapathum folio rotundo alpinum, J. B. & Tourn.* round-leaved mountain or garden Dock. MONKS RHUBARB. Rhapontic.

Sixteen drams of this root yielded with rectified ſpirit ſeven drams and a ſcruple of extract, and afterwards with water three drams and a half, five drams and half a ſcruple remaining undiſſolved. On inverting the procedure, and treating the ſame quantity of the root firſt with water and afterwards with ſpirit, I obtained ten drams two ſcruples of watery, and one ſcruple of ſpirituous extract; the reſiduum weighing five drams and a few grains.

The extracts made at firſt, whether by water or by ſpirit, contain the active matter of the Rhapontic, both the ſecond extracts having little or no taſte. The yellow colour of the root is more perfectly taken up by ſpirit than by water, and more concentrated in the ſpirituous than in the watery extract. The ſpirituous extract is alſo ſtronger in taſte than the watery: On firſt taſting, they both prove ſweetiſh, but ſoon after diſcover a degree of pungency.

VIII. ARNICA. ARNICA SCHWEEDENSIS ſomewhat reſembles in its flowers the *Arnica* formerly mentioned, and has by ſome been miſtaken for it. It is nevertheleſs a quite different plant, a ſpecies not of *Doronicum* but of *Aſter*, named by Tournefort *Aſter pratenſis autumnalis conyzæ folio.* It differs alſo greatly in quality, being not at all emetic or purgative, but aſtringent, and hence recommended in alvine fluxes. Nor does it yield ſo much ſoluble matter to watery or ſpirituous menſtrua: An ounce of the flowers

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(*f*) *Monks Rhubarb.*] The roots of this plant, though they have pretty much of the appearance of true Rhubarb, come far ſhort of it in quality: they nauſeate the ſtomach, and though given in double the doſe of Rhubarb they ſcarcely produce any evacuation. It is obſervable that the young ſhoots in the ſpring approach in taſte to ſome ſorts of apples: Of late, they have been employed in that early ſeaſon, as a ſuccedaneum to apples for culinary purpoſes.

gives

ARNICA. gives hardly a dram of reſinous, and about two drams of gummy extract.

IX. TORMENTIL. TORMENTIL, *Tormentilla Sylveſtris*, C. B. is a low creeping plant, with ſmall indented leaves ſtanding ſeven together, and yellow tetrapetalous flowers, growing ſometimes in meadows, but chiefly in ſandy and hilly places. It is called Tormentil from its being ſerviceable againſt fluxes with *Tormina* or Gripes; from the number of its leaves it is named *Heptaphyllum*, Septfoil.

The root, which is the only part made uſe of, is ſlender, never thicker than the little finger, very knotty, irregular, and variouſly bent, externally of a brown colour, internally reddiſh with white or yellow ſtreaks, of a ſomewhat aromatic aſtringent taſte, with ſcarcely any ſmell. It is employed as a mild aſtringent and corroborant: By ſome it has been ſubſtituted to Peruvian bark in the cure of intermitting fevers: By ſome it has been mixed with a little emetic Tartar as a ſuccedaneum to Ipecacoanha in dyſentries.

This root is extremely hard and compact, and does not readily part with its active matter on digeſtion either in water or in ſpirit: It does however, by degrees, give out the whole of its virtue to both menſtrua. The ſpirituous extract is much more ſtyptic and of a deeper red colour than the watery; not that ſpirit takes up more from the root than water does, but from its taking up leſs of the inert matter, whence the active parts are more concentrated: An extract made by ſpirit after water is as inſipid as that made by water after ſpirit.

From two ounces of the root cut in ſmall pieces, I obtained by rectified ſpirit ſix drams five grains of extract, and afterwards by water two drams two ſcruples and a half; the reſiduum weighing ſeven drams five grains. The ſame quantity, treated firſt with water, gave nine drams and a half of gummy extract, and afterwards with ſpirit only eight grains of a reſinous matter; the reſiduum amounting to ſix drams twenty-two grains. In diſtillation, rectified ſpirit brings over nothing; the diſtilled water diſcovers a little of the aromatic taſte of the Tormentil-root, and a ſlight agreeable ſmell, ſomewhat like that of Roſewood.

TORMENTIL.

X. GALLS.

GALLS are excreſcences found upon the Oak-tree, produced by an inſect, which wounds the young branches in the ſpring, and depoſites its eggs in the puncture: The tear which iſſues from the wound, gradually increaſed by acceſſions of freſh matter, forms a covering to the young inſect, which at length eats its way out, leaving the Gall hollow. When the Gall has no perforation, the inſect is found dead within it. Sometimes alſo, after the eſcape of its own, it is occupied by other inſects.

There is a great variety of Galls, whitiſh, yellowiſh, greeniſh, browniſh, reddiſh, greyiſh and blackiſh, ſmall and large, round and irregular, light and heavy, ſmooth, and with protuberances on the ſurface. The ſmall, blackiſh, protuberant, and ponderous, are the beſt. Theſe are the produce chiefly of the Turkiſh dominions, and brought immediately from Aleppo, Tripoli, and Smyrna: Thoſe of Europe are greatly inferior.

As all the parts of the Oak-tree are notably aſtringent, it is natural for this excreſcence to poſſeſs that quality; and in effect Galls are found to be one of the ſtrongeſt of the vegetable ſtyptics: Hence they ſtrike a deep black colour with ſolution of Chalybeate Vitriol, and are employed in conjunction with that Salt, preferably to other vegetables, for dying cloth black, and for making ink; theſe are the principal uſes to which they are applied. They are rarely uſed medicinally, unleſs as an external ſtyptic. Monſ. Reneaume, in the French Memoirs for the year 1710, recommends them internally againſt intermitting fevers, in preference even to Peruvian-bark, as being free from the bitterneſs of that medicine, occaſioning no heat, and not requiring to be given in ſo large doſes: It is proper to obſerve however, that great caution is requiſite in the exhibition of ſtrong aſtringents in that diſorder.

GALLS.

Extracts made from Galls, both by water and by ſpirit, poſſeſs the whole of their aſtringency, but the ſpirituous extract is ſtronger and more diſagreeable than the watery. An extract made by ſpirit after water has no particular taſte, but an extract made by water after ſpirit taſtes manifeſtly ſaline, and exhibits ſome ſmall ſhining particles of an actual Salt.

Sixteen drams of Galls groſsly powdered, yielded with water fourteen drams of extract, and afterwards with ſpirit only four grains; the reſiduum weighing two drams. The ſame quantity, treated firſt with ſpirit and afterwards with water, gave twelve drams two ſcruples of ſpirituous, and four ſcruples of watery extract; the reſiduum weighed half a ſcruple more than in the former caſe.

XI. GENTIAN.

GENTIAN, ſaid to be ſo called from Gentius a King of Illyria who is ſuppoſed to have firſt diſcovered it, grows in ſome of the mountainous parts of Switzerland, Hungary, France, *&c.* from whence the ſhops are ſupplied with the dried roots. The leaves are ſomewhat like thoſe of White-hellebore, the flowers monopetalous and yellow; whence the plant is named by John Bauhine *Gentiana vulgaris major ellebori albi folio*, and by Caſpar Bauhine *Gentiana major lutea.* The root is externally of a brown [illegible]lour, internally yellow, with a pith in the middle [illegible] of the woody kind but rather more ſpongy [illegible] reſt of the root; the older and larger the root, the more porous; the younger and ſlenderer, the more compact: The beſt roots are thoſe which are of a middling ſize and a lively yellow colour.

This root has a light not diſagreeable ſmell, and an intenſely bitter taſte. It is an excellent ſtomachic and corroborant: By ſome it is greatly recommended in intermitting fevers, and diſtinguiſhed by the title of European Kinkina. The ſurgeons frequently make uſe of it in old wounds, ulcers and fiſtulæ; not ſo much however, as ſome pretend, from any peculiar quality of obtunding acrimonious juices, as from its imbibing moiſture, and ſwelling thereby, and thus dilating the orifice or keeping the lips aſunder.

Sixteen

GENTIAN.

Sixteen drams of this root yielded with rectified ſpirit ſix drams and a half of reſinous extract; and afterwards with water three drams and a half of a gummy one: The ſame quantity, treated firſt with water and then with ſpirit, gave nine drams of gummy and only a ſcruple of reſinous extract: The reſiduum in the firſt caſe weighed ſix drams, in the latter two ſcruples more.

The extract made at firſt by ſpirit contains all the bitterneſs of the Gentian, and is the moſt active preparation of it: The gummy matter extracted afterwards with water is inſipid. The extract made at firſt by water is indeed very bitter, but leſs ſo than the ſpirituous, both on account of its quantity being larger, and a part of the bitter matter being ſtill left in the root; for the Reſin gained from the reſidue diſcovers a manifeſt bitterneſs. In diſtillation, ſpirit brings over nothing: The diſtilled water has a ſlight impregnation from the Gentian, but too inconſiderable to deſerve any notice (*g*).

XII. WHITE DITTANY.

WHITE or BASTARD DITTANY, *Dictamnus albus vulgo ſive Fraxinella, C. B.* grows in the mountainous parts of Italy, Hungary, &c. produces irregular polypetalous flowers, and leaves like thoſe of the *Fraxinus* or Aſh-tree. In the ſhops we meet

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(*g*) *Gentian.*] The Gentian uſed among us comes chiefly from Ger[illegible] Some years ago, a quantity was brought over which had an admixture of pieces of a different root, the uſe of which occaſioned violent diſorders, and in ſome inſtances death. This poiſonous root is readily diſtinguiſhed from Gentian by its being externally of a paler colour, and internally not at all yellow, but white: Chewed, it diſcovers nothing of the bitterneſs of Gentian, nor any other than a ſlightly pungent mucilaginous taſte.

Phyſicians were at that time at ſome loſs for a ſuccedaneum to Gentian; and indeed among the great number of vegetable bitters, we ſcarcely know of one that poſſeſſes the valuable qualities of this root, which is not only a ſtrong but an almoſt ſimple flavourleſs bitter. Chemiſtry however can eaſily purify the other bitters, and bring them to the ſame ſtate with that of Gentian: It can diſſipate their offenſive flavour, and preſerve the bitterneſs unhurt. If the dry leaves of common Wormwood be boiled in water, and the decoction boiled down to the conſiſtence of an extract, the diſguſtful matter of the Wormwood will all exhale in the boiling, and may be caught and collected by itſelf, whilſt the extract proves ſimply bitter, as ſtrong, as flavourleſs and innoffenſive, as an extract made from Gentian. This extract gives out its pure bitterneſs to rectified Spirit of Wine as well as to Water.

WHITE DITTANY. with the cortical part of the root, which is of a whitiſh colour, a bitter taſte, and without any ſmell; the inner, woody, inſipid pith being taken out. The ſmall young roots, about the ſize of a quill, are much the ſtrongeſt.

This root contains a much larger proportion of gummy than of reſinous matter: Out of ſixty drams, water takes up ſix drams two ſcruples and a half; rectified ſpirit only four ſcruples two grains: The matter left by ſpirit gave five drams two ſcruples and two grains to water; but the matter left by water gave to ſpirit no more than half a ſcruple. The extract made at firſt by ſpirit is the moſt active preparation: The watery extract is far leſs bitter. The diſtilled water has ſome little taſte; the diſtilled ſpirit has no other taſte or ſmell than pure Spirit of Wine. This root has been ranked among the ſtomachics, alexipharmics, and anthelmintics; but it does not promiſe, however, any great virtue (*b*).

XIII. LESSER CENTAURY. In the two foregoing plants, the bitterneſs is confined to the roots: In the LESSER CENTAURY, it is only the herb, or the part which ariſes above ground, that is bitter. Centaury is ſo called from *Centum* and *Aurum*, on account of its excellent virtues; and agreeably to this derivation, it is named by the Germans *Tauſend-gulden-kraut*. The ſpecies here intended [illegible] the *Centaurium minus*, *C. B.* It grows chiefly in [illegible] ſandy grounds, and if the ſeaſon proves alſo dry, is extremely apt to fail: As in ſome ſummers we meet with very little, it is proper to lay in a ſtock in thoſe years when it is plentiful. The leaves are ſlender, furniſhed with three ribs like thoſe of Plantane, but ſmaller and narrower: There is commonly a buſh of leaves upon the ground, but on the ſtalk no more than twelve, which ſtand in pairs. The flowers are numerous, and often cluſtered together into the form

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(*b*) *White Dittany.*] The root of this plant yields no eſſential Oil in diſtillation, but the leaves a conſiderable quantity: The Oil has a ſtrong unpleaſant ſmell, ſomewhat of the Terebinthinate kind, like that of the herb itſelf. It is ſaid that when the herb is in vigour, its effluvia in very hot dry weather, takes fire on the approach of a candle, and forms a large lambent flame, which ſpreads all over the plant.

Leſser Centaury.

of Umbels: They conſiſt of ſingle, purpliſh red, funnel ſhaped petula, which ſhut in the night, and open in the day-time. The ſhops are generally ſupplied with the herb in flower, tied up in bundles, though the flowers have little or nothing of the bitterneſs for which the plant is valued.

Theſe flowers, like other red ones, loſe their colour on being kept: It is obſervable that the change begins in the lower narrow part of the flower next the cup, and proceeds gradually upwards, the upper edge retaining its colour longeſt. The leaves of Leſſer-centaury, are almoſt ſimply bitter, with very little of any ſmell or particular flavour: They are excellent ſtomachics and corroborants in intermitting fevers, cachexies, dropſies, *&c.* Maurice Hoffman relates, in the *Ephemerides naturæ curioſorum*, that he cured two hydropic caſes with powdered Centaury alone, and hence gives the plant the name of *Gentiana hydropica.*

The bitterneſs is taken up both by water and by ſpirit; the tincture and extract made with the latter are the ſtrongeſt. An ounce of the dry tops yielded with rectified ſpirit three drams two ſcruples of reſinous, and afterwards with water two drams one ſcruple of gummy extract; the reſiduum weighed two drams, or one fourth of the quantity of Centaury employed. Another ounce, treated firſt with water, gave five drams one ſcruple of gummy extract, and afterwards with rectified ſpirit two ſcruples of Reſin; the reſiduum weighing, as before, juſt two drams. The green colour of the herb reſides in the reſinous principle, being extracted by rectified ſpirit and not by water. In diſtillation, neither water nor ſpirit receive any conſiderable impregnation.

XIV. Carduus.

CARDUUS BENEDICTUS (*Cnicus ſylveſtris hirſutior ſive Carduus Benedictus, C. B.*) is another bitter plant, whoſe bitterneſs is confined chiefly to the leaves. Four ounces of dry Carduus leaves yielded with rectified ſpirit four drams and a half of reſinous extract, and afterwards with water ſix drams and a half of a gummy one, the indiſſoluble earthy part amount-

CARDUUS. ing to two ounces and five drams. The ſame quantity on applying firſt water and afterwards Spirit of Wine, gave ten drams of gummy extract, and only one dram of Reſin.

The freſh plant has a weak not agreeable flavour, which ariſes in diſtillation with water, eſpecially if the Carduus is previouſly fermented for a little time: In drying, it loſes its flavour, and in this ſtate gives over nothing. The expreſſed juice duly depurated and evaporated to the thickneſs of a ſyrup yields, on ſtanding, ſaline cryſtals, approaching to the nature of Tartar.

XV. HORE-HOUND. THE freſh leaves of HOREHOUND (*Marrubium album vulgare, C. B.*) have a bitteriſh taſte, with a peculiar not diſagreeable ſweetiſh ſmell, reſembled by ſome to that of Citrons, by others to that of Muſk, but which ſeems to approach nearer to that of rectified Spirit of Wine.

Their ſmell is diſſipated in drying, and elevated by water in diſtillation, but not by pure ſpirit; the diſtilled water gives no appearance of any oily matter. The bitterneſs remains uninjured in both the extracts; the ſpirituous is much the ſtrongeſt, and in ſmalleſt quantity; it poſſeſſes the true ſpecific taſte and flavour of the herb, together with its green colour.

An ounce of the dried leaves yielded four drams and a half of watery, and afterwards half a dram of ſpirituous extract: Rectified ſpirit applied at firſt extracted two drams and a half, and water afterwards two drams and a ſcruple: The reſiduum in the firſt caſe weighed three drams, in the latter three drams ten grains.

XVI. WORM-SEED. WORMSEED, *Semen lumbricorum, ſemen contra vermes*, ſo called from its uſe againſt worms, is a bitter ſeed, ſaid by ſome to be the produce of China, by others of the Holy Land: whence its names *Semen Cinæ* or *cinæ*, *Semen ſanctum*, *Sementina*, *Santonicum*. The plant which affords it is not as yet known with any degree of certainty: By ſome it is referred to the genus of Wormwood, by others to that of Southernwood, and by others to that of Lavender-Cotton.

Taver-

WORM-SEED.

Tavernier relates, that he found the plant growing in fields in the province of Boutan; that the ſeeds when ripe, fall off upon the ſlighteſt touch, are ſo light as to be blown away by the wind, and that they are gathered by applying baſkets to the plant. As brought to us, they are commonly mixed with a notable quantity of ſmall bits of ſtalks and leaves, which cannot be ſeparated by winnowing, on account of the great lightneſs of the ſeed itſelf. Ettmuller ſuppoſes that the Wormſeed of the ſhops is no other than the ſeeds of Tanſy; but from thoſe it is entirely different in its figure and appearance as well as in its ſmell and taſte: The ſeeds both of Tanſy and other plants, however, are not unfrequently mingled with it. Large quantities are imported immediately from Venice: I have there ſeen ſome of a fine green colour, which is held a mark of its freſhneſs, though I have been aſſured, that the dealers have a method of impregnating the old decayed yellow ſeeds with the admired colour. Thoſe commonly met with are of a yellowiſh-green colour, a bitter taſte, and a very diſagreeable ſmell.

Water extracts more from theſe ſeeds than rectified ſpirit; but the ſpirituous extract is far ſtronger than the watery, the former retaining the whole of the ſmell and taſte of the ſeeds, whilſt in the latter very little even of their taſte is preſerved. An ounce of the beſt Wormſeed, digeſted in freſh parcels of rectified ſpirit, ſo long as it continued to give any tinge to the menſtruum, yielded on inſpiſſating the tinctures, three drams thirty-three grains of reſinous extract; after which, it gave with water, five ſcruples and a half of a mucilaginous one. On treating another ounce firſt with water and then with ſpirit, I obtained four drams and a ſcruple of gummy extract, and only twenty-eight grains of Reſin. The reſiduum in the firſt caſe, weighed two drams thirty-eight grains; in the latter, two drams fifty-four grains.

In diſtillation, rectified ſpirit brings over nothing. The diſtilled water taſtes and ſmells of the ſeeds, but ſcarcely exhibits a ſingle particle of Oil, though a whole pound be committed to diſtillation at once.

WORM-SEED.

The *Oleum cinæ* therefore, which has long been kept in the (German) ſhops, cannot be a genuine eſſential Oil diſtilled from Wormſeed.

XVII. CONTRAYERVA.

CONTRAYERVA, is the root of a climbing ſpecies of Paſſion-flower, with leaves ſomewhat reſembling a horſe ſhoe (*Clematis paſſionalis, folio bifido, Moriſon*) growing in the Spaniſh Weſt-Indies, particularly in Peru and Mexico.

The leaves of the plant are ſaid to be poiſonous, and to be employed by the Indians for poiſoning darts: The root is held an antidote to this and to other poiſons, and from this ſuppoſed virtue, the Spaniards give it the name of Contrayerva, that is, Counterpoiſon. The phyſicians of our own country expect from it no ſuch virtues; but they frequently exhibit it as a diaphoretic and alexipharmic in low fevers.

This root is about the thickneſs of the little finger, ſeldom more, thicker at one end than the other, very crooked, knotty, full of fibres, extremely firm and hard, almoſt of a horny texture, of a reddiſh-brown colour on the outſide, and ſomewhat whitiſh or greeniſh within, of a ſlight kind of aromatic ſmell, of an aſtringent taſte, not remarkably pungent, having a particular flavour in the mouth. Extracts made from it both by water and ſpirit are conſiderably pungent: The watery extract is the leaſt ſo, and [illegible] may be uſed in ſome fevers where the ſpirituous tinctures or extracts would heat and ſtimulate too much. Neither the diſtilled waters nor the ſpirits have any remarkable impregnation from the Contrayerva.

An ounce of the powdered root yielded with water three drams and half a ſcruple of extract, and afterwards with ſpirit only ſeven grains: rectified ſpirit, applied at firſt, took up five ſcruples and two grains from an ounce; after which, water extracted near a dram.

XVIII. SWALLOW WORT.

WHEN Contrayerva is ſcarce, SWALLOW-WORT root is ſometimes uſed in its ſtead. Swallow-wort, *Vincetoxicum, aſclepias, hirundinaria* (*Aſclepias albo flore, C. B.*) grows wild in woods, and produces white flowers

SWALLOW WORT.

flowers in July and Auguſt: It has a number of ſlender roots or fibres hanging from a ſomewhat larger one, of a not diſagreeable ſweetiſh taſte, accompanied with a kind of bitteriſhneſs, and a ſlight pungency, when freſh of an unpleaſant ſmell, which is in good meaſure loſt in drying.

The juice of the freſh root changes the colour of blue paper to a reddiſh, and thus diſcovers a degree of acidity: When dry, it gives no mark of any acid, unleſs committed to diſtillation in an open fire, in which caſe, like other vegetable matters, it gives over an acid phlegm or ſpirit. Extracts made from this root both by water and vinous ſpirits have an agreeable ſweetiſh taſte. The watery extract is ſtronger in taſte than the ſpirituous; and even the watery extract made after the action of ſpirit is ſtronger than that made by ſpirit after the action of water; hence water appears to be the moſt proper menſtruum in regard to the quality as well as the quantity of the product.

From ſixteen ounces of the root I obtained by water five ounces; and from the remainder, by ſpirit, one ounce. Another pound, treated firſt with ſpirit, gave only four ounces: From the remainder water extracted two; the indiſſoluble earthy matter amounting in both caſes to ten ounces or five eights of the root. What ariſes in diſtillation, either with water or with ſpirit, is entirely inconſiderable.

XIX. VALERIAN.

VALERIAN root is ſometimes employed in the ſame intentions as the two foregoing, but its principal uſe is as an antiſpaſmodic: There are ſundry inſtances of epilepſies cured by the powder of this root given from a ſcruple to a dram and a half in white Wine, a laxative being premiſed. In the warmer parts of Europe, Italy, Spain, Portugal, &c. the garden Valerian (*Valeriana hortenſis, phu folio oluſatri dioſcoridis C. B. Valeriana odorata radice J. B.*) is chiefly made uſe of; but in our colder climate, this garden ſpecies proves far inferior in quality to the wild ſort, *Valeriana ſylveſtris major, C. B.*

Valerian.

The leaves of wild Valerian have a bitteriſh ſubſaline taſte, but no ſmell. Their juice changes blue paper conſiderably red, a mark that they contain an eſſential ſalt of the acidulous kind. The root when largeſt, is about the thickneſs of the finger, but in general much thinner, of a browniſh grey colour on the outſide and paler within, knotty, with numerous matted fibres, of a pungent aromatic, bitteriſh ſomewhat ſtyptic taſte, and a ſtrong diſagreeable ſmell, approaching to that of Indian Nard, and in ſome degree to that of Virginian Snakeroot, to which Valerian root has frequently been employed as a ſuccedaneum. The fibres are ſtronger in ſmell and taſte than the tuberous part of the root: A good deal of care is requiſite to waſh and clean them from the earth which ſticks among them.

An ounce of the dry root, thoroughly cleaned, cut and bruiſed, yielded with rectified ſpirit three drams and ſix grains of reſinous extract, and afterwards with water one dram and fourteen grains of a gummy one: Another ounce, treated firſt with water, gave four drams twenty-one grains, after which rectified ſpirit extracted only five grains: The indiſſoluble reſiduum weighed, in the firſt caſe three drams forty grains, in the latter three drams thirty grains. The diſtilled ſpirit is ſlightly, and the diſtilled water pretty ſtrongly impregnated with the ſmell of the Valerian, but no ſeparable oil is obtained. The moſt active preparation is the ſpirituous extract, which is conſiderably more pungent and more bitter than the watery, and contains all the uſeful matter of the root concentrated into a ſmall volume.

The root of the ſmaller wild Valerian (*Valeriana paluſtris minor*, *C. B.*) is nearly ſimilar to the foregoing, but weaker. The principle in which its odour reſides, is more groſs and ponderous, no part of it being elevated in diſtillation by Spirit of Wine. The diſtilled water exhibits ſome appearance of oilineſs. This root appears alſo to contain ſome portion of an Oil of the expreſſible kind, whence the extract made by ſpirit after water proves unctuous and rancid. An extract made by water after ſpirit is in taſte ſaline;

The

Valerian.

The ſpirituous extract made at firſt has an agreeable ſmell and an aromatic bitter taſte; the watery is in taſte weaker, and in ſmell offenſive. An ounce of the root yielded with water four drams and a half, and afterwards with rectified ſpirit ten grains: From another ounce I obtained, by applying ſpirit at firſt, two drams two ſcruples; and afterwards by water, two drams and half a ſcruple: The reſiduum in the firſt caſe weighed three drams one ſcruple, in the latter ſomewhat leſs.

LIBRARY OF THE ROYAL

XX. Peony.

THE roots and ſeeds of Peony are reckoned alſo ſpecific antepileptics, but their virtues are perhaps rather imaginary than real. The red ſingle flowered Peony (*Pæonia folio nigricante ſplendido quæ mas, C. B.*) has been ſuppoſed to be the moſt efficacious, though at preſent the ſingle and double flowered ſorts are for the moſt part taken indiſcriminately.

The roots of Peony are pretty thick, tuberous, of a brown colour on the outſide and a pale reddiſh within: When freſh they have a ſomewhat pungent ſweetiſh taſte, accompanied with a degree of bitteriſhneſs. Hermann ſays they have no ſmell: They have a weak, but a very ſenſible one, not reſembling that of any other ſubſtance I know of.

An ounce of the dry roots yielded with water four drams and a ſcruple of gummy extract, and afterwards with rectified ſpirit only half a ſcruple of Reſin: The reſiduum weighed three drams and a half. Rectified ſpirit applied at firſt extracted, from an ounce, two drams and an half; from the remainder, water took up two drams, leaving as before, three drams and a half undiſſolved.

The ſpirituous extract is of all the preparations the ſtrongeſt both in taſte and ſmell: On firſt taſting, it diſcovers a remarkable ſweetneſs, which is followed by a diſagreeable bitterneſs, like that of the root in ſubſtance: The ſpirituous extract made after water has the ſame kind of taſte in a lower degree. The watery extracts have only a ſlight ſweetiſhneſs: Theſe are of a darker and browner colour than the ſpirituous. The

PEONY. diſtilled water ſmells and taſtes conſiderably of the Peony.

Flowers. The flower of Peony is large, like a Roſe: The fruit conſiſts of three, four or five oblong horned pods, which open ſpontaneouſly when the ſeeds are ripe. Seeds. The ſeeds are at firſt of a reddiſh colour, which deepens into a Garnet red, then changes to a violet, and at laſt to a bright gloſſy black: Under the coloured ſhell is contained a white kernel, which taſtes ſomewhat like peas.

An ounce of the huſked ſeeds, boiled with water, gave two drams of extract, of an oily ſmell and a ſweetiſh taſte: The remainder, treated with rectified ſpirit, gave half a dram of an inodorous bitteriſh extract: The indiſſoluble part weighed five drams and a half. On inverting the order of applying the menſtrua, I obtained by ſpirit five ſcruples from an ounce, and afterwards by water two ſcruples and a half, the reſiduum weighing as before five drams and a half: The ſpirituous extract appeared very unctuous or oily, taſted and ſmelt not diſagreeably, and ſeemed to be the moſt active preparation: The watery was both in ſmell and taſte very nauſeous, like rancid Oil. In diſtillation, ſpirit brings over nothing, and water exceeding little.

XXI. SCROPHULARIA. SCROPHULARIA, Figwort, (*Scrophularia nodoſa fœtida,*) is ſo called from the ſuppoſed virtues of its root againſt ſcrophulous diſorders. An ounce of the dry root, digeſted and boiled in ſeveral freſh parcels of water, yielded upon evaporating the decoctions, five drams and a half of extract; after which, rectified ſpirit extracted but five grains, two drams and a half remaining undiſſolved. On inverting the order of applying the reſpective menſtrua, the ſpirituous extract weighed four drams, the watery one dram and a half, and the reſiduum as before, two and a half.

The extract made by applying water firſt, was in taſte conſiderably ſweet, and not diſagreeable; the firſt ſpirituous extract was ſtronger and ſomewhat bitter: The watery extract made after ſpirit had no taſte; the ſmall quantity of reſinous matter, which ſpirit ex-

tract-

SCROPHULARIA.

tracted after the action of water, was quite diſagreeable and ſomewhat rancid. The diſtilled water has very little taſte or ſmell, the diſtilled ſpirit none.

XXII. POLYPODY.

POLYPODY (*Polypodium vulgare, C. B.*) is a plant ſomewhat approaching in appearance to thoſe of the Fern-kind, growing upon old Oaks and other trees, as alſo upon old walls and rocks: It has no flowers; the ſeed is a fine duſt lying on the back of the leaves. The roots are numerous, irregular, full of fibres and knots, ſuppoſed to reſemble the feet of an inſect, whence the name Polypody, *i. e.* Many-feet: They are externally of a brown colour, internally of a fine yellowiſh green, eaſy to break, of a ſweet but ſomewhat nauſeous taſte, without any ſmell: Some of them diſcover a degree of acrimony and aſtringency.

An ounce of the root, freed from the fibres, yielded with rectified ſpirit three drams, and afterwards with water one dram of extract: Another ounce, treated firſt with water, gave three drams two ſcruples, and afterwards with ſpirit only one ſcruple; the indiſſoluble earthy part amounting in both caſes to four drams, or half the weight of the root. The ſpirituous extract is manifeſtly oily; and on this oil, which is of expreſſible and not of the eſſential kind, the nauſeous taſte of the Polypody ſeems to depend: The ſpirituous extract is extremely nauſeous and rancid, the watery much more agreeable. In diſtillation, nothing conſiderable ariſes either with water or with ſpirit.

This root is ſometimes given in obſtructions of the breaſt and viſcera, and ſuppoſed to be gently laxative, but it poſſeſſes that virtue in ſo low a degree, that two or three drams have ſcarcely any effect.

XXIII. DORONICUM.

DORONICUM or Leopard's bane, is another root of a ſweet but unpleaſant taſte, accompanied with a bitteriſhneſs and aſtringency, and whoſe qualities are but little known. The plant, called by Caſpar Bauhine *Doronicum radice dulci*, grows wild in ſtony grounds, in Italy, Auſtria, Switzerland, Languedoc and ſome other parts of Europe. The root comes

chiefly

DORONICUM. chiefly from Italy, whence the name *Doronicum Romanum:* It is jointed, not very large, furniſhed with long fibres, of a yellowiſh colour on the outſide and white within.

From two ounces of the dry root were obtained by water fourteen drams of extract, and afterwards by ſpirit five grains, only two drams remaining undiſſolved. The ſame quantity yielded, with ſpirit at firſt, four drams and a half, and afterwards with water nine drams, the reſiduum amounting to two and a half. The firſt ſpirituous extract is in taſte much ſtronger and ſweeter than the watery, though the watery contains alſo nearly all the active matter of the Doronicum. The diſtilled water has ſome little ſmell and taſte; the diſtilled ſpirit has neither.

This root is by ſome accounted poiſonous, by others alexipharmic. It is moſt commonly ſuppoſed to be poiſonous only to quadrupeds; or if it is noxious to men when freſh, to be innocent when dry.

XXIV. IRIS. THE roots of the common garden IRIS or Flower-de-Luce (*Iris vulgaris violacea ſive purpurea ſylveſtris, C. B.*) are when freſh ſtrongly purgative: I have known unfavourable conſequences even from their external uſe as a coſmetic. By drying they loſe their virulence, ſo as ſcarcely to purge at all. [illegible] is

Florence Orris. THE dry roots of the Florence Iris or Orris (*Iris alba florentina, C B.*) are entirely mild, and ſaid to be a medicine of good ſervice in diſorders of the breaſt. They have a pleaſant ſweet ſmell reſembling that of Violets, and hence are employed in ſweet-ſcented powders, for flavouring liquors, *&c.* The diſtilled water ſmells a little of the root, but exhibits no appearance of Oil: The diſtilled ſpirit alſo has ſome ſlight ſmell. The ſtrongeſt preparation, both in ſmell and taſte, is the ſpirituous extract, this containing nearly all the active parts of the root concentrated into a ſmall volume. An ounce of the root yielded a dram and ſeventeen grains of ſpirituous, and afterwards a dram and forty grains of watery extract: Water applied at firſt extracted from the ſame quantity three drams, and ſpirit afterwards only eight grains. The extract made by water at firſt both taſtes and ſmells of the Orris, though not near ſo ſtrongly as the ſpirituous.

XXV. HYPERICUM. THE flowers of ST. JOHN'S WORT (*Hypericum vulgare, C. B.*) abound with Reſin: They diſcover even to the touch an unctuous, reſinous balſamic juice. An ounce yielded with rectified ſpirit juſt half an ounce of extract. They contain however ſo much mucilaginous matter, as to render nearly all the Reſin, or at leaſt all its active parts ſoluble in water: An ounce yielded five drams of watery extract, in taſte aſtringent and diſagreeable. Water applied after ſpirit, extracted two drams; ſpirit after water, only two ſcruples. The indiſſoluble earthy part weighed in the firſt caſe two drams, in the latter a ſcruple more. In diſtillation, nothing conſiderable ariſes either with water or ſpirit. It is obſervable, that the firſt tincture made in rectified ſpirit is of a fine red colour; but that when this is poured off, and the flowers digeſted in a freſh parcel of ſpirit, they tinge it greeniſh——These flowers are ſuppoſed to be reſolvent, vulnerary, nervine: The ſuperſtition of former times aſcribed to them alſo extraordinary antidæmoniacal powers.

XXVI. GOLDILOCKS. THE flowers of the GOLDEN STÆCHAS or yellow Caſſidony (*Elichryſum ſeu Stæchas citrina anguſtifolia, C. B.*) are remarkable for preſerving their freſh yellow colour in long keeping: Some have a pleaſant muſky ſmell, others have none: Their taſte is pungent, aſtringent and bitteriſh. An ounce yielded three drams forty-four grains of watery, and afterwards fifteen grains of ſpirituous extract, half an ounce remaining undiſſolved. On inverting the order of applying the menſtrua, the ſpirituous extract weighed two drams forty-four grains, the watery one dram three grains, and the reſiduum four drams twelve grains. The extracts made firſt, either by water or ſpirit, are aſtringent; the ſpirituous is the ſtrongeſt. The diſtilled water has ſome ſlight flavour of the flowers, and the ſpirit ſcarcely any.——Theſe flowers are uſed for ſtaining hair yellow, and medicinally as an aſtringent, anthelmintic, &c. They likewiſe give a yellow dye to wool.

XXVII. TEA.

TEA is the leaf of an oriental ſhrub called by Caſpar Bauhine *Chaa herba in Japonia*, by Breynius and Ray *Thé Sinenſium ſive t'sja Japonenſibus*, by Kæmpfer *Thea frutex*, &c. "the Tea-ſhrub, with leaves like thoſe of the Cherry-tree, flowers like thoſe of the Dog-roſe, and a fruit compoſed of one, two, and for the moſt part, three berries." The plant comes the neareſt, in its general appearance, to the Dog-roſe, but is ſmaller, and without prickles. Dr. Cleyer, who lived ſome time in the Eaſt-Indies, ſent ſeveral ſpecimens to Simon Paulli in Denmark, and Dr. Mentzel in Berlin; of which figures may be ſeen in the *Acta Haffnienſia* and the German *Ephemerides*.

Only one ſpecies of the Tea-plant is as yet known; the differences in this commodity as brought to us, proceeding from a difference in the climate, ſoil, age, method of collection and curation: Some indeed mention a ſingle and a double-flowered ſort, but of this we have no certainty. It is ſaid by ſome to be a native of China only, by others both of China and Japan: Others add a third country, Siam; and ſuppoſe, not without probability, that the Japonic named *Tſia* is derived from thence. Thus much is certain, that at preſent it is regularly cultivated in different provinces of Japan and China, but does not in all prove of equal goodneſs: Fiſien in Japan, and Nankin in China produce the beſt.

The Chineſe plant whole fields with Tea; the Japaneſe only the borders of fields fronting the South: From ſix to a dozen of the berries are planted together (as they are very apt to fail) and covered with dung and earth: It is ſaid, that they are three years in coming up, and that they are carefully covered in the winter with ſtraw. After a certain number of years, which Kæmpfer limits between ſeven and ten, appear the admired leaves: After theſe have been gathered, the plant is either cut down, and new ſhoots expected from the root, or extirpated and renewed from ſeed. As the berries are extremely apt to ſpoil, inſomuch as to require being planted quite freſh in their native climate, and as the ſhrub does not bear being removed

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removed entire, there are little hopes of our being ever able to introduce it into Europe: Nor would it, probably, in theſe colder climates, prove equal in quality to the Chineſe, ſince even in China and Japan it proves greatly different in different provinces.

If the winter does not prove very ſevere, the leaves come forth in February, and about the end of this month, or the beginning of the next, the firſt collection is made. Theſe early tender leaves are the true *Imperial*, called alſo improperly *bloom* Tea; but they cannot be the ſort to which the Dutch give that name, as being ſold upon the ſpot, to the princes of the country, for vaſtly more than the common Bloom-tea is ſold for in Europe. About the end of March or the beginning of April, the ſecond and moſt conſiderable crop is gathered: A large linen cloth is ſtretched over the buſh, to defend from the ſun not only the gatherers, but the leaves themſelves, leſt they ſhould dry too faſt, and loſe their flavour. The leaves are picked one by one, ſo curiouſly, that the moſt induſtrious can ſcarcely collect four pounds in a day. They are commonly divided into four ſortments; of which the ſmaller upper ones are the beſt, the larger lower ones the worſt, and the intermediate of a middling goodneſs. The third collection is in the end of April or beginning of May: This likewiſe affords different ſorts, which are thoſe moſtly brought into Europe: The very beſt ſort which we meet with here, called Imperial Tea, is but the lower leaves of the ſecond crop. About the end of May, all the leaves on the plant are gathered promiſcuouſly, without ſorting, and ſold about the ſtreets to the poorer people; theſe being the worſt of all, and unfit for being cured in the Chineſe manner.

The Japaneſe, who ſwallow their Tea in ſubſtance along with its infuſion, dry it haſtily in iron pans over the fire, and grind it into powder. The Chineſe, on the other hand, are very curious of preſerving the leaves entire, and roll them up that they may be leſs apt to break in carriage. So ſoon as gathered, they are brought into an apartment furniſhed

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niſhed with a number of little furnaces, each of which is covered with a ſmooth iron plate. The leaves are ſpread upon the plates, and kept rolling with the hands, in one direction, till they become moderately dry, and begin to curl up about the edges, when they are immediately ſwept off upon tables covered with ſmooth cloſe mats, on which one perſon continues to roll them over and over, whilſt another fans them, that they may cool haſtily, and retain the curl. This proceſs is repeated two or three times or oftener, according as the leaves are diſpoſed to unbend upon ſtanding. If exſiccated without artificial heat, or by a very ſoft one, they rarely take the curl, and never hold it.

Meiſter relates, that the leaves are put into a hot kettle juſt emptied of boiling water; and that in this they are kept cloſely covered till cold, and then committed to the hot plates: According to Lemery, they are held in the ſteam of water. But Kæmpfer mentions nothing of all this; and if any ſuch thing is practiſed in regard to Green-tea, I ſhould imagine it to be only for ſoftening ſuch of the leaves as have happened to grow too dry, and would break in the curling. Boerhaave pretends that the preparers employ green Vitriol for improving the colour of the leaf. This I judge to be falſe, becauſe green Vitriol, inſtead of heightening the green colour of Tea, changes it to an inky blackneſs.

Thus much of the Green-tea. With regard to Bohea, I have not been able to meet with any ſatisfactory account, either in books, or from the communications of merchants; of both which, great numbers have been conſulted. Kæmpfer, and Dr. Cunningham, phyſician to the Engliſh ſettlement at Chuſan, affirm, that it is the leaves of the firſt collection; but this muſt certainly be a miſtake, as all the travellers agree, that none of the firſt crop is brought into Europe, but that it is all reſerved for the princes of the land, and ſold at an immenſe price in China itſelf; whereas Bohea comes over in large quantity, and is cheaper than the ſecond and third crops, if not than the fourth alſo.

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Poſſibly a particular kind of Bohea is made from the firſt crop, for the uſe of the nobility; and our Bohea, prepared in imitation of that, from the third and fourth collections, or perhaps from the earlier growths alſo in thoſe provinces where the plant does not come to ſuch perfection as to afford a good Green-tea. The dark-browniſh colour, and Roſe flavour obſerved in this kind of tea, I hold, with Sigeſbeck, to be artificial: The method of curation deſcribed by Meiſter, which certainly is in general not practiſed for the Green, probably is for the Bohea, which receives, perhaps, in the kettle, both its tincture and its flavour. This at leaſt is certain, that by a ſimilar proceſs good Bohea may be made among ourſelves; a ſpecimen of which I have exhibited to a numerous audience. Some of the dealers in this commodity, in England, are not ignorant that certain European leaves, particularly thoſe of the Dog rose and Cherry tree, may be ſo coloured and prepared, as to paſs for good Bohea. But I forbear to ſay any thing further of this manufacture, leſt a handle ſhould be given for new abuſes.

The Japan Tea has been obſerved to be of a clearer green colour than the Chineſe, and to have its leaves ſmaller; but which of the two is the beſt has not hitherto been determined, ſome preferring the one, and others the other: This controverſy does but little concern us, the Chineſe being the only one brought into Europe. In China, Tea is divided into a great number of different ſortments: There are ſixteen or twenty of the green leaves, from the difference in the collection only; and theſe are further multiplied, when the leaves are dry, by picking out ſuch as have miſcarried in the preparation. Among us, there are three principal kinds of green, and five of Bohea: From what province they are brought, of what crop they are the produce, and to which of the Chineſe ſorts they belong is unknown: They have all names, but theſe are merely arbitrary, and ſerve only for the conveniency of the dealer. The beſt of the Green-teas called Bing, Imperial and Bloom-tea, *Thea imperia-folio amplo laxo* of Dale: The ſecond beſt, *Hyſſon*,

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Thea viridis optima folio oblongo Dal: The third or worſt, *Singlo*, *Thea viridis folio minore Dal.* Of Bohea (*Thea fuſca folio ad nigredinem vergente*) the ſorts are, Ordinary, Pecco, Congo, Camho, and Souchong; of which the firſt is the worſt, and the laſt is the beſt.

The Chineſe are extremely curious and cleanly in every branch of the Tea manufacture. They gather the leaves, as I have been well aſſured, with gloves made of a thin kind of leather. The workmen employed in the curation are reſtrained, for a fortnight before, from flatulent foods, and whatever might endanger communicating any ill flavour. The Tea, when cured, is packed up in large veſſels made of a mixture of Lead and Tin called Calin, or in wooden cheſts lined with this compoſition, or in canniſters of tinned plates ſoldered with the ſame, ſo tight, that they may be kept occaſionally under water.

As ſoon as Tea became known in Europe, with its uſes among the Chineſe, all the European nations thirſted after it. Its great price at that time confined it to the rich, whence the learned were induced to examine the European plants, with a view to diſcover a cheap ſuccedaneum to it. The moſt celebrated of our ſubſtitutes is *Veronica*, on which Hoffmann and Joh. Francus have written particular diſſertations. The leaves of the red Whortle-berry and Roſe buſh are at preſent in greater eſteem, and come nearer to the taſte of the true Tea than any of the other plants that have been employed for this purpoſe, as Betony, Nettles, Agrimony, Coltsfoot, Eyebright, Strawberry, Scabious, Cowſlips, Golden-rod, Cherry-tree, Peach-tree, Wall-rue, ſharp leaved Plantane, Sanicle, Liverwort, Longwort, Brankurſine, Balm, Sage, Roſemary, &c. I admit, with the recommenders of theſe plants, that they are poſſeſſed of conſiderable virtues, greater in particular caſes, than any that Tea can pretend to; yet ſtill they want the chief excellence of Tea, that of being a diluent almoſt univerſally acceptable.

Some pretended to have diſcovered the orie
Tea itſelf in Europe or America. The firſt of

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was Simon Paulli, who obſtinately maintained that Tea was no other than the *Chamæleagnus* or Dutch Myrtle, but was refuted by ſeveral botaniſts in Europe, and by the ſpecimens ſent by Dr. Cleyer. The next was Father Labat, who in his voyages to America, relates, that in Martinico there grows a plant called wild Tea, agreeing in all reſpects with the China ſort, except that it has not ſo much of the Violet ſmell; "for in every other reſpect, he ſays, it is aſſuredly "the ſame thing." He adds further, that he had procured Tea-ſeeds from the Eaſt-Indies, and raiſed the plant in America. That he was miſtaken here (as he often was in botanic matters) is obvious from his own account: His ſeeds were ſmaller than Poppy ſeeds, whilſt thoſe of Tea are a kind of large nut or berry: His flowers had each but four ſtamina, whilſt in one of the Tea-flowers Kæmpfer counted two hundred and thirty. The plant is no other than that called in England Weſt-India Tea, *Lyſimachiæ purpureæ affinis Americana, procumbens, anonidis vernæ fruteſcentis folio ſingulari glabro* of Plukenet, found plentifully by Sir Hans Sloane about Spaniſh-Town in Jamaica. About twenty years ago there was another pretended diſcovery of Tea in the imperial dominions. But this like the others, when examined by a botaniſt, was found to be a quite different plant, the *Botrys ambroſioides mexicana* of Caſpar Bauhine. The Jeſuits have at times made great noiſe with this plant, under the name of Roman Tea. I ſhall here add one more kind of Tea, uſed lately in France: When I was in Paris, about the year 1718, Tea and Coffee being common liquors, thoſe who affected diſtinction drank nothing but *Apalathine*, ſo called from the American territory of which it is the produce: It is the leaf of a tree ſomewhat reſembling the Almond, called by the natives *Caſſine*, by Hermann *Euonymo affinis æthiopica, ſempervirens, fructu globoſo ſcabro, foliis, ſalicis, rigidis, ſerratis.* We ſhall now drop the counterfeits, and return to the true Tea.

The Oriental Tea, as we have already ſeen, is of kinds; Green and Bohea. The firſt is not only nally green, but likewiſe imparts the ſame colour

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to Water; the freſher the Tea, the greener is the infuſion; its prevailing ſmell is generally that of violets or new hay: Bohea on the other hand is externally of a blackiſh brown colour, gives a browniſh tincture to Water, and ſmells of roſes. Green Tea ſhould be choſen freſh, of a fine colour, not inclining to a yellowiſh or browniſh, which are marks of too great age, well rolled, conſiſting of entire leaves, thoroughly dry ſo as to be friable betwixt the fingers, of a bitteriſh ſubaſtringent not ungrateful taſte, and a pleaſant light ſmell. When either the Violet or Hay-ſmell are very ſtrong, we may ſuſpect them to be introduced by art, the leaves having but little from nature: The firſt is communicated by putting into the caniſters a little Florence Orris root; the latter, by placing the Tea for a few days, wrapt in papers, among new made Hay; this leaf being remarkably ſuſceptible of any kind of flavour. There are other abuſes common among the Dutch; as mixing, with the Tea, leaves of European growth and manufacture; and introducing into the old decayed Green, a freſh tincture.

The preparation and uſe of Tea as a dietetic liquor, are in general well known. With regard to its medical effects, ſome have exceſſively extolled, and others as extravagantly condemned it. The moſt virulent of its antagoniſts is Simon Paulli, who had ſeizes every opportunity of expreſſing his diſlike to it: His royal Maſter, the King of Denmark, who had found great benefit from Tea, he vehemently diſſuaded from continuing its uſe, affirming it to be extremely unwholeſome; but all he gained from his Majeſty was this equivocal anſwer, *Credo* TE *non eſſe ſanum.*

Tea is in many caſes a very uſeful liquor; a grateful diluent in health, and a ſalutary drink in ſickneſs: It attenuates viſcid juices, promotes the natural excretions, excites appetite, and proves ſerviceable particularly in fevers, in immoderate ſleepineſs, after a debauch, and in head-achs ariſing from that cauſe: No other plant is known, whoſe infuſion paſſes off more freely by the emunctories of the body, or meets

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ſpeedily excites the ſpirits. It is not however without its inconveniences: In habitual colics it is found to do harm; and in urinary obſtructions it ſhould be ſparingly drank: Its immoderate uſe is productive of cacochymic, cachectic, chlorotic diſorders; and weakens the tone of the ſtomach and nervous ſyſtem. It is ſaid, when new, to be narcotic, and to diſorder the ſenſes; but to loſe this quality, in great part by the exſiccation, and totally by being kept for a year: In the Tea countries, it is a principal caution to abſtain from it till this period, but in Europe there is no danger of its being uſed too new.

Some aſcribe the good or ill effects obſerved from the uſe of Tea wholly to the leaves, and others to the Water. The ſimple element has undoubtedly a conſiderable ſhare in both: It is not, as ſome have ſuppoſed, the virtue of the Tea-leaf, but the warm aqueous liquor, with the climate and diet, that preſerves the inhabitants of China and Japan from calculous and gouty diſorders—But on the other hand, that the herb communicates alſo ſome peculiar qualities to the liquor, is equally certain: In weak ſtomachs, a moderately ſtrong infuſion of Tea, without Sugar, generally provokes a puke: An infuſion of two or three drams of Bohea in two ounces of Water, is a common emetic among the Chineſe; and the Green is ſometimes employed in the like intention among ourſelves.

It remains to examine the phyſico-chemical ſtructure of Tea. Authors in general make a ſaline ſubſtance its prevailing principle: One ſtands up for a volatile, another for a fixed Salt; one for an alcaline, another for an acid, and another for an oily ſalt; one will have it ſmooth, another pointed and rough; one nitrous, and another ſulphureous. But all theſe Salts are creatures of imagination, experiment diſcovering nothing of them. The experimental analyſis of Tea turned out as follows:

An ounce of fine Green Tea, digeſted with freſh [illegible]cels of Water, yielded four drams two ſcruples of [illegible]my extract; and afterwards, with Spirit, only one [illegible]le of reſinous extract; three drams remaining

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undiſſolved. On inverting the order of applying the reſpective menſtrua, an ounce gave four drams and a half of ſpirituous, and afterwards four ſcruples of watery extract; the reſiduum weighing three drams ten grains. The green colour reſides wholly, and the aſtringency chiefly, in the reſinous part; the reſinous extract, made by applying Spirits at firſt, being much ſtronger and more aſtringent; and at the ſame time more ungrateful, than the gummy extract prepared by applying Water at firſt. In diſtillation, pure Spirit brought over nothing from the Tea: Water elevated all its flavour.

An ounce of Bohea yielded with Water five drams of gummy, and afterwards with Spirit one ſcruple of reſinous extract; two drams and a half of indiſſoluble matter being left: Another ounce, treated firſt with ſpirit, gave three drams and a ſcruple of reſinous, and afterwards five ſcruples of gummy extract; the reſiduum amounting to three drams. Though the watery tinctures of Bohea are different in colour from thoſe of the Green, the ſpirituous are nearly of the ſame green colour. The diſtilled Waters alſo are in flavour much alike, and the diſtilled Spirits equally void of flavour. But the firſt reſinous extract of Bohea is conſiderably leſs ungrateful than that of the other; and the Reſin extracted after Water, more ſo.

A ſpirituous extract made from either kind of Tea, poſſeſſes the whole of its taſte and ſmell: But in the watery extract, prepared in the common manner, all the fine flavour of the leaf is loſt. Nevertheleſs, if the inſpiſſation of the watery infuſion be performed without communication with the air, and in the gentle heat of a water-bath, the extract will turn out, next to the infuſion, one of the moſt elegant preparations. Such an extract, curiouſly prepared, may be of uſe to travellers; the bulk of a pea, diſſolved in Water, forming an extemporaneous Tea, without any apparatus. According to Ion[illegible] the Indians themſelves have a preparation of this k[illegible] for making Tea upon a journey.

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A Solution of Vitriol of Iron dropt in ſmall quantity into an infuſion of Tea, changes its colour to a muddy Violet: A larger quantity turns it to an inky blackneſs, a proof that Tea poſſeſſes an aſtringent quality. On ſtanding for ſome time, a precipitate falls: It is pretty ſingular, that after the precipitation, the liquor appears greeniſh. Infuſions of Tea, like thoſe of other vegetables, are made deeper coloured by alcalies, particularly by thoſe of the fixed kind; and paler by acids, both of the mineral and vegetable kingdom.

XXVIII. COFFEE.

COFFEE is originally the produce of Arabia, and was not known in Europe till the year 1650: It is now cultivated alſo in Perſia, in the Eaſt-Indies, particularly the iſland Java, and in America. It is raiſed likewiſe in botanic gardens in different parts of Europe, but not without ſhelter and artificial heat: Prince Eugene's noble garden at Vienna produced Coffee more than ſufficient for his own conſumption.

The tree is uſually ſmall, though ſometimes it riſes to the height of twenty, thirty, and even forty feet: It is an evergreen, and at all ſeaſons of the year is found loaded with flowers and fruit. The flower is highly odoriferous, and reſembles that of the Jaſmine, of which the Coffee-tree is held a ſpecies: Juſſieu calls it *Jaſminum Arabicum lauri folio, cujus ſemen apud nos Café dicitur.* The Arabians name the tree *Bun* or *Bon*, whence the common expreſſion of Coffee *Beans*: The dietetic infuſion prepared from the ſeeds, they call *Cahouah*, or *Coave*, whence *Coffee* or *Caffee*. The entire fruit ſomewhat reſembles a cherry: It contains under a pulpy ſkin, an oval kernel, which ſeparates longitudinally into two parts, each covered with a thin ſhell and marked with a furrow on the flat ſide where they were joined. The ripe fruit is thoroughly dried in the ſun, and heavy wooden or ſtone rollers paſſed over it; by which the ſeeds are parted, and the ſkins or ſhells broken, ſo as to be ſeparated by winnowing.

Three ſorts of Coffee are diſtinguiſhed in trade; Arabian or Levant, Eaſt-Indian or Java, and Weſt-

COFFEE. Indian or Surinam Coffee: The firſt is the ſmalleſt, and of a ſomewhat darker yellow colour than the other ſorts; the ſecond is the largeſt and of the paleſt yellow; the third of a middling ſize, and in colour greeniſh. The green colour of this laſt may probably proceed from its coming over freſher than the others, or perhaps from its not attaining to ſuch a degree of maturity. All the ſorts are green in their unripe ſtate; and even thoſe, which by maturity or age have acquired the darkiſh yellow or browniſh colour, give a green tincture to water.

Two ounces of theſe ſeeds yielded with Water five drams, and afterwards with Spirit twenty-ſix grains of extract: On treating the ſame quantity firſt with Spirit and then with Water, the ſpirituous extract amounted to three drams and a half, and the watery to two drams: The indiſſoluble reſiduum weighed in both caſes ſomewhat more than ten drams and a half: In diſtillation, rectified Spirit brings over nothing, and Water nothing conſiderable. The ſpirituous extract is in taſte the ſtrongeſt, and not a little nauſeous: The watery is ſweetiſh and agreeable.

The peculiar flavour for which Coffee is admired, is communicated by roaſting: Common Beans, Peas and other farinaceous ſubſtances, receive from that proceſs a ſimilar flavour, and have been ſometimes uſed as ſuccedanea to Coffee, and fraudulently mixed, by the venders of that commodity, with ſuch as is ſold in powder. Dillenius has given an expreſs diſſertation (in the *Ephem. Nat. Curioſo.*) on the ſubſtances which in ſmell and taſte reſemble Coffee; and finds that roaſted Rye and roaſted Almonds, come the neareſt to it.

Sixteen ounces of Coffee were reduced by roaſting to twelve ounces: The exhaling vapour, caught in proper veſſels, condenſed into a liquor weighing four ounces, chiefly aqueous, ſlightly impregnated with acid, and with a ſubtile Oil of an empyreumatic but agreeable ſmell like that of the roaſted Coffee itſelf.

The flavour of the roaſted ſeeds depends on a ſimilar oily matter, ſo volatile as to be diſſipated on keeping, but in too ſmall quantity to be collected in its

proper

COFFEE.

proper form by diſtillation either with Water or Spirit: The diſtilled Water taſtes and ſmells conſiderably of the Coffee, the diſtilled Spirit much leſs.

Sixteen ounces of roaſted Coffee yielded ſeven ounces two drams two ſcruples of watery, and afterwards five drams one ſcruple of ſpirituous extract: On inverting the procedure, I obtained from the ſame quantity, four ounces four ſcruples of ſpirituous, and four ounces of watery extract: The reſiduum in both caſes was nearly in the ſame quantity, namely eight ounces, or one half of the Coffee.

The ſpirituous extracts of Coffee are in taſte nauſeous: The watery, particularly that made by applying Water at firſt, are ſufficiently agreeable, ſomewhat like that of Walnuts, with a pleaſant bitteriſhneſs.

With regard to the medical qualities of Coffee, the common infuſions or rather decoctions of it appear to be in general innocent; to be little diſpoſed to produce the ill effects aſcribed to them by ſome; and to have little claim to the extraordinary virtues for which they are recommended by others. Simon Paulli was the firſt who condemned the uſe of Coffee as well as Tea; But his prejudices againſt it are built on no better foundation than a ridiculous hiſtory related in Olearius's travels.

XXIX. VERONICA.

VERONICA or MALE SPEEDWELL (*Veronica mas ſupina & vulgatiſſima C. B.*) a ſmall plant common in uncultivated places, is greatly recommended by Hoffmann and Joh. Francus as a ſubſtitute to Tea, and is ſaid to be of excellent ſervice in diſorders of the breaſt and many other diſeaſes.

The leaves of Veronica have a bitteriſh ſomewhat aſtringent taſte, with a very weak ſmell. An ounce of the leaves, picked and dried, yielded with Water five drams and a ſcruple, and afterwards with Spirit only nine grains of extract, the reſiduum weighing two drams thirty five grains: On inverting the order of applying the menſtrua, I obtained, from an ounce, three drams two ſcruples of ſpirituous, and a dram and half of watery extract, the indiſſoluble reſiduum amounting to two drams forty-ſix grains.

The

VERONICA.

The extract made by Spirit at firſt contains the green colour, and all the active matter of the herb; rectified Spirit extracting the whole of its taſte and ſmell, and elevating nothing in its exhalation. The watery extract is weaker than the ſpirituous: The diſtilled Water ſmells and taſtes a little, and but a little, of the Veronica: If the herb be previouſly fermented, we obtain by diſtillation a liquor ſtrongly impregnated with its flavour.

Hoffman reports, that Veronica, burnt to aſhes, yields a larger quantity of fixed alcaline Salt than any other plant except Wormwood. I made the experiment three different ways. Sixteen ounces of the leaves, diſtilled in a retort, left five ounces of a black coal, which by gentle burning in the open air, was reduced to one ounce of aſhes: From this were obtained, by elixation with Water and inſpiſſation, two drams and two ſcruples of Salt. Another pound of the leaves being burnt ſlowly with a ſmothering heat, the aſhes weighed an ounce and a half, and the Salt two drams thirty-five grains, of which one dram and a half aſſumed a cryſtalline form. A third pound, burnt with a flaming fire, gave ten drams and a half of aſhes, from which were obtained one dram of cryſtalliſed and four ſcruples of inſpiſſated ſalt. This plant therefore does not afford near ſo much Salt as has been reported, nor is the Salt purely alcaline, great if not the greateſt, part of it being, as Stahl has juſtly obſerved, marine Salt. The aſhes, in the two firſt experiments, were ponderous, and of a yellowiſh white colour; in the laſt, they were light, ſpongy, and of a bluiſh white.

XXX. LUNGWORT.

LUNGWORT; *Pulmonària*, is a ſpecies of Moſs (*Muſcuspulmonarius*, *C. B.*) growing upon trees, of a very irregular figure, concave and greeniſh on the ſide next the tree, convex and yellowiſh on the upper ſide, full of holes, thin, membranous, like leather or paper, internally of a whitiſh colour. It has been held a ſpecific in diſorders of the breaſt and lungs, as alſo in dyſenterics, vomiting, &c. though the virtues aſcribed to it do not appear to have any good foundation.

LUNG-WORT.

[illegible] ounce, digeſted in freſh parcels of rectified Spirit, gave five drams wanting half a ſcruple of reſinous extract; and afterwards with Water only twelve grains of a gummy one: Another ounce, treated firſt with Water and then with Spirit, yielded three drams of gummy and two ſcruples of reſinous extract: So that a conſiderably larger quantity of the two extracts is gained when Spirit than when Water is applied firſt.

I obſerved alſo, that the green colour reſides in the reſinous parts; that the ſpirituous extract is difficultly reduced to a due conſiſtence; that the firſt ſpirituous extract is very apt to grow mouldy, contracting in a ſhort time not only white hairy effloreſcences, but likewiſe a yellow powdery matter; that the firſt extracts, whether made with Water, or with Spirit, retain in part the ill ſmell perceivable in the Lungwort itſelf; that in diſtillation, Spirit of Wine ariſes unchanged; and that the diſtilled Water has only a kind of ungrateful muſtineſs.

XXXI. PAREIRA BRAVA.

PAREIRA BRAVA, *Butua, Cipo de Cobra,* is the root of a velvet-leaved climbing plant, growing in the Brazils, called by Ray *Convolvulus Brazilianus, flore octopetalo, monococcus.* The root is pretty large, irregular, of a woody texture, compoſed of longitudinal fibres, which partly ſeparate in drying, ſo as to leave manifeſt vacuities.

Mr. Geoffroy, in a ſhort Memoir for the year 1710, makes two ſorts of this root; one of a whitiſh colour on the outſide and a Citron yellow within, the other brown without and browniſh yellow within. I have been aſſured, that both are the roots of the ſame plant; that the young roots are externally ſomewhat whitiſh, and internally of a light Citron yellow; and that by age they become paler within, and of a dark ſometimes blackiſh brown colour without.

This root is ſaid by Pomet to have been firſt introduced into France in the year 1688, by M. Amelot then embaſſador in Portugal. Helvetius brought it into great eſteem as a medicine, for diſſolving and promoting the expulſion of thick viſcid juices, in nephritic, icteric, hydropic and other diſorders. It has

PAREIRA BRAVA. no ſmell unleſs warmed, in which circumſtance it ſmells ſomewhat like liquorice: To the taſte it diſcovers as it were a ſweetneſs and bitterneſs blended together.

An ounce cut in ſmall pieces, and digeſted in freſh parcels of rectified Spirit of Wine ſo long as it continued to give any tinge to the menſtruum, yielded on inſpiſſating the tinctures, two drams three grains of reſinous extract, after which, Water extracted one dram, leaving five drams undiſſolved. On inverting the order of applying the reſpective menſtrua, the ſame quantity of the root yielded two drams one ſcruple of watery, and afterwards one dram ſix grains of ſpirituous extract: The indiſſoluble reſiduum weighed in this caſe but four drams and a half. The firſt ſpirituous extract is in taſte the ſtrongeſt of all the preparations: The firſt watery extract alſo contains nearly the whole of the active matter of the root, though it does not prove near ſo ſtrong as the ſpirituous: The extracts made by Spirit after Water, or by Water after Spirit, have very little taſte. Nothing ariſes in diſtillation either with Spirit or with Water.

XXXII. CHINA-ROOT. CHINA, CINA, or SCHINA-ROOT is of two kinds, Oriental and Occidental. The two plants differ little or nothing in the leaves, flowers, or ſeeds, but conſiderably in the root, and remarkably in the time of flowering; the Chineſe blowing only in June and July, whilſt the American produces flowers ſucceſſively almoſt all the year. By ſome botaniſts they are referred to the genus of *Smilax aſpera*, by others to that of *Senecio:* The flower is compoſed of a number of floſculi, of a gold yellow colour; the leaves narrow and indented, like thoſe of Dandelion.

The root, when freſh, is fleſhy and full of juice; as brought to us, hard and woody: It is very irregular, and full of knots. The Oriental ſort which is accounted the beſt, is commonly ſhorter, thicker, leſs crooked and leſs knotty than the American: It is alſo of a much paler reddiſh white colour on the inſide, the American being of a pretty deep reddiſh, nearl like that of Biſtort: The outſide is of a reddiſh brow

China root.

a full brown, or a blackiſh. The greateſt quantities are brought over by the Dutch Eaſt India company, in bags of one hundred and twenty-five pounds: The merchants in Batavia give the Chineſe, for ſuch a bag, commonly four florins, ſometimes more, at the higheſt ten.

As this root is very ſubject to be preyed upon by worms, the induſtrious Dutch have contrived means for palliating that imperfection. I was once in a houſe at Amſterdam, where the manufacture of Aſafetida, Caranna, Caſtor, Muſk and ſundry other drugs, was carried on. Among other ingenious operators, there were ſix perſons ſitting by a diſh, making old worm-eaten China roots as fair and freſh coloured as any that ever came from China. They had a maſs compoſed of powdered China-root, Bole Armenic, and Gum Tragacanth, with probably ſome admixture of Litharge, for it was very heavy: This looked, when dry, exactly of the reddiſh-white colour of the internal part of the root. With this mixture they curiouſly filled all the holes they could come at, then penciled the root all over with ſome of the ſame maſs diluted afterwards with another tincture, and laſtly rubbed it with Soap.

The beſt China-root is moderately compact and heavy; when broke, not mealy or duſty, but cloſe and of an oily or reſinous appearance. It has no ſmell, and ſcarcely any taſte, or only a ſlight kind of aſtringency. Two ounces yielded five ſcruples of ſpirituous extract, and afterwards four drams fourteen grains of watery extract: On inverting the order of applying the menſtrua, I obtained from the ſame quantity, five drams ten grains of watery, and afterwards only fourteen grains of ſpirituous extract.

Decoctions of this root drank freely, are ſaid to promote perſpiration and urine, and have been greatly commended in the venereal diſeaſe: They do not appear, however, to have any conſiderable virtue. If this root poſſeſſes any medicinal activity, the ſpirituous extract promiſes from its taſte to be the beſt preparation.

XXXIII. Sarsaparilla.

SARSAPARILLA, Salſaparilla, Zarza, the root of another American *Smilax*, conſiſts of a num-

SARSAPARILLA.

ber of long, ſmooth, flexible ſtrings hanging from one head, eaſily ſplit from end to end. There are different ſpecies of this plant, and the roots of ſeveral of them are met with in the ſhops. Monardus diſtinguiſhes three: One brought from New Spain, of a whiter colour and ſlenderer than the reſt; another, from the province Honduras, of a darker aſh-grey colour, thicker, and better than the foregoing; and the third, from the neighbourhood of Guayaqui in the province of Quito (hence called *Sarſaparilla Guajaquillana*) of a darker colour than either of the others, inclining to black, thicker, longer, ſometimes of the length of a man. Three ſorts are at preſent alſo diſtinguiſhed in the ſhops; one of which comes over in circular coils, another in ſhort, and the third in long bundles: The firſt is called Virginian or Engliſh, the ſecond Spaniſh, and the third Liſbon Sarſaparilla. The firſt is univerſally preferred, the others being ſubject to have decayed roots and different foreign matters in the middle of the bundle. It is rare to meet with Sarſaparilla that is truly good. The beſt is externally of a light brown colour, not greyiſh, or dark brown, much leſs of a blackiſh hue: Internally it is white, and in appearance as it were farinaceous, with a compact pith in the middle, not porous or ſpongy, much leſs powdery or duſty. It has no ſmell, and hardly any taſte, or only a juſt perceptible bitteriſh and ſomewhat mucilaginous one.

From ſixteen drams of the choiceſt roots were obtained ſix drams of watery, and afterwards only half a ſcruple of ſpirituous extract: Spirit applied at firſt to the ſame quantity of the root, extracted four drams, after which water took up two; the indiſſoluble earthy reſiduum weighed in the firſt caſe nine drams fifty grains, in the latter ten drams. Both the extracts made at firſt were bitteriſh, with this difference, that the ſpirituous was the moſt diſagreeable, and the watery ſomewhat ſaline: The ſecond extracts, or thoſe made by water after ſpirit, and by ſpirit after water, had ſcarcely any taſte. Neither water or ſpirit brought over any thing conſiderable in diſtillation.

SARSAPARILLA.

This root is ſaid to be remarkably ſerviceable in venereal and cancerous diſorders, and in impurities and viſcidities of the blood and juices in general. Some have given it in the form of powder, but it is more generally and more advantageouſly directed in decoctions. The watery decoction and extract ſeem to be the beſt preparations, though the ſpirituous alſo are not to be rejected——The colour of the tinctures is nearly the ſame with thoſe of Sopewort; the ſpirituous being of a yellowiſh red, and the watery of a reddiſh-brown.

XXXIV. SOPEWORT.

SOPEWORT, *Saponaria (Saponaria major levis, C. B.)* ſo called from the freſh leaves of the plant cleaning the hands like Sope, grows wild in woods and meadows, but is eaſily propagated in gardens: It loves a moiſt and ſomewhat ſandy ſoil: It rambles ſurprizingly with its roots, ſpreading in a little time to a vaſt compaſs, ſo as not to be eaſily extirpated.

The root is long and ſlender, with knots and fibres here and there, covered with a reddiſh-brown bark, under which lies a white tough ſubſtance, and in the middle a yellowiſh pith. This root has no manifeſt ſmell: Its taſte is ſweetiſh, accompanied with a light pungency. It has lately come into eſteem as a reſolvent and purifier of the blood, of great ſervice in venereal and ſcrophulous diſorders, ſimilar, but ſuperior to Sarſaparilla: Stahl was extremely fond of it.

On a chemical analyſis, by water and rectified ſpirit, two ounces of the root yielded eleven drams of watery, and only half a ſcruple of ſpirituous extract, the reſiduum weighing four drams two ſcruples and a half: Two other ounces, treated firſt with ſpirit and then with water, gave five drams of ſpirituous, and ſix drams of watery extract, the reſiduum amounting to five drams. All the active parts are taken up by the menſtruum applied at firſt, whether watery or ſpirituous; the extracts made by water after ſpirit, or by ſpirit after water, having ſcarcely any perceptible taſte.

Both the firſt extracts, on being chewed a little, cover the mouth and fauces with a pleaſant, ſoft,

ſmooth,

SOPE-WORT. ſmooth, ſlippery ſubſtance, like frothy Saliva, accompanied with a ſlight warmth and pungency: The ſpirituous is ſweeter and ſtronger than the watery: The colour alſo of the ſpirituous tincture is a deeper reddiſh than that of the watery decoction. In diſtillation, ſpirit elevates nothing, and the diſtilled water has only a juſt ſenſible kind of ſweetiſhneſs.

XXXV. BURDOCK. THE roots of common BURDOCK (*Bardana, perſonata, lappa major*) are nearly ſimilar in quality to the foregoing: They have a ſlight ſweetiſh taſte without any ſmell, and are ſuppoſed to poſſeſs the ſame medicinal virtues. This root is pretty long, an inch or more in thickneſs, externally of a yellow, a browniſh, and ſometimes of a dark brown colour, internally for the moſt part ſomewhat hollow, moderately compact and of a blackiſh-grey colour towards the ſurface, lined here and there with a white ſoft matter, and furniſhed with a white ſpongy pith in the middle.

Sixteen drams of the dry root yielded with water ſeven drams fifty-two grains of extract, and afterwards with rectified ſpirit two ſcruples and a half; from the ſame quantity, treated firſt with ſpirit, I obtained five drams ten grains, after which water extracted three drams two ſcruples two grains: When ſpirit was uſed firſt, the indiſſoluble reſiduum weighed ſeven drams fourteen grains; when water, ſeven drams twenty-two grains. Water appears to be the beſt menſtruum, and the diſtilled liquor to be of no value.

It is affirmed in the *Ephemerides naturæ curioſorum*, that the leaves of this plant deflagrate in the fire like Nitre; and hence it is concluded, that Nitre, or a nitrous Salt, is one of its eſſential ingredients. We have formerly obſerved, that plants imbibe Nitre from nitrous ſoils: The Nitre in this experiment, was no other than that caſual impregnation. I have burnt the leaves of Burdock, and ſtrewed upon burning coals an eſſential Salt extracted from them, without obſerving the leaſt deflagration or mark of Nitre.

TUR-

XXXVI. TURMERIC.

TURMERIC, *Curcuma*, *Terra merita*, is the root of an oriental plant, called by Tournefort *Cannacorus radice crocea*, growing in Cananor, Calecut, Goa, Malabar, *&c.* There are two ſorts of this root, a long and a round: The firſt is the beſt, and hence is the only one commonly made uſe of. It ſhould be choſen large, freſh, compact, ponderous, not eaſy to break, of a fine yellow colour on the outſide, and a deep reddiſh-yellow within: It has a bitteriſh taſte, and ſmells ſomewhat like Ginger.

This root is uſed by the Indians as a ſpice: Medicinally, it has been ſometimes given as a reſolvent in cachectic, icteric, hypochondriacal, hyſterical and other diſorders; but its principal uſe is as a colouring drug, for dying cloth and ſtaining leather yellow, and in yellow varniſhes. It is obſervable, that fixed and volatile alcalies heighten its colour into a red, whilſt the nitrous and vitriolic acids weaken and incline it to a blackiſh-brown: If the root, however, be afterwards dried, its colour appears not to be greatly different from what it was at firſt.

It gives out its colour both to watery and ſpirituous menſtrua (*i*). Sixteen drams yielded with water five

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(*i*) *Turmeric—colour to water and ſpirit.*] It communicates to water its own deep yellow colour, but to rectified Spirit of Wine a red. The ſpirituous tincture, applied upon warm Marble, gives a durable red ſtain. Woollen cloth, impregnated with a ſolution of Alum and Tartar, acquires on being boiled with the watery decoction, an elegant, but not very durable Orange yellow or Gold coloured dye. It is rarely made uſe of by the dyers on account of its price and the periſhableneſs of its colour.

There are ſeveral other colouring drugs which belong to this claſs: The principal are Fuſtick, Nephritic-wood, Log wood, Brazil wood, and Madder.

FUSTICK.

FUSTICK is the wood of a ſpecies of Mulberry-tree, growing in Jamaica and Brazil, called by Sir Hans Sloane *Morus fructu viridi, ligno ſulphureo tinctorio.* It is of a deep Sulphur yellow colour, which it readily gives out both to water and to ſpirit. The watery decoction dyes prepared woollen of a very durable Orange-yellow: The colour is imbibed by the cloth in a moderate warmth without boiling.

The *Fuſtet* or *Fuſtel* of the French is a yellow wood or root very different from our Fuſtick: It gives a fine Orange dye to woollen, but the colour is extremely periſhable in the air. The plant grows wild in Italy and

TURMERIC.

five drams and one ſcruple of extract, and afterwards with ſpirit only two ſcruples and a half, ten drams remaining.

WOODS.

and Provence, and is cultivated with us in gardens on account of the beauty of its flowers: It is called *Venice ſumach*, *Cotinus coriaria* or *Coccigria*; *Cotinus matthioli, C. B.*

NEPHRITIC-WOOD.

THIS wood is brought from the Eaſtern countries in large pieces, covered with a dark blackiſh bark. The wood is hard, heavy, compact, of a fine grain, of a whitiſh or pale yellow colour on the outſide, and a duſky reddiſh-brown in the heart. Of the tree we have no very certain account.

This wood, particularly the outer pale part, gives out both to water and to rectified ſpirit, a deep tincture, appearing when placed betwixt the eye and the light, of a golden colour, in other ſituations blue. Hence it is named by Caſpar Bauhine *Lignum peregrinum aquam cæruleam reddens.* By this mark it is eaſily diſtinguiſhed from pieces of a different kind of wood, which are ſometimes mixed with it, and which give only a yellow tincture to water.

It is remarkable, that the blue colour of the infuſion of Nephritic-wood is deſtroyed by acids, the liquor after the admixture of theſe, appearing in all ſituations yellow; and that the addition of alcalies, either of the fixed or volatile kind, in quantity ſufficient to neutralize the acid, reſtores the blueneſs. No other woody matter is known that gives any degree of blue tincture; and no other vegetable blue is known, that is thus deſtructible by acids.

This wood is at preſent rarely met with in the ſhops. Nor is it applied to any uſe, except that ſome have employed it medicinally, and expected from its diuretic virtues, whence its name *Nephritic-wood.*

LOGWOOD.

LOGWOOD or Campeachy wood (*Lignum brazilio ſimile, cæruleo tingens J. B.*) is the wood of a low prickly tree, which grows plentifully about Campeachy on the Bay of Honduras, and has of late been introduced into ſome of the warmer of the Britiſh plantations, particularly Jamaica: It is a native of low marſhy places. The wood comes over in pretty large logs, cleared from the bark: It is very hard, compact, heavy, and of a red colour.

Logwood gives out its colour both to watery and ſpirituous menſtrua, but not readily to either: It requires to be raſped and ground into fine powder, and boiled in ſeveral freſh parcels of the liquors. Rectified ſpirit extracts the colour more eaſily, and from a larger proportion of the wood than water does.

The tinctures both in water and in ſpirit are of a fine red, with an admixture, particularly in the watery one, of a violet or purple. Volatile alcaline Salts or Spirits incline the colour more to purple: The vegetable and nitrous acids render it pale; the vitriolic and marine acids deepen it.

The watery decoction, wrote with on paper, loſes its redneſs in a few days, and becomes wholly violet. This colour it communicates alſo to woollen-cloth previouſly prepared by boiling with a ſolution of Alum and Tartar: The dye is beautiful, but very periſhable. It is often uſed

by

remaining undiſſolved. The ſame quantity, treated firſt with ſpirit, gave two drams and a half, and afterwards

TURMERIC.

WOODS.

by the dyers, as an ingredient in compound colours, for procuring certain ſhades which are not eaſily hit by other materials.

With Chalybeate ſolutions, it ſtrikes a black. Hence it is employed in conjunction with thoſe liquors, for ſtaining wood black for picture-frames, &c. and with the addition of Galls, for dying cloth and hats black. The black dyes, in which this wood is an ingredient, have a particular luſtre and ſoftneſs, far beyond thoſe made with Galls and Vitriol alone: The beauty, however, which it here imparts, is not permanent, any more than its own natural violet dye.

On the ſame principle, it improves alſo the luſtre and blackneſs of writing ink. Ink made with Vitriol and Galls, does not attain to its full blackneſs till after it has lain ſome time upon the paper: A due addition of Logwood renders it of a deep black as it flows from the pen, eſpecially when Vinegar or white Wine is uſed for the menſtruum.

Decoctions and extracts made from Logwood have an agreeable ſweetiſh taſte, followed by a ſlight aſtringency. They have lately been introduced into medicine, and given with ſucceſs in caſes where mild reſtringents are required. They often tinge the ſtools, and ſometimes the urine of a red colour.

BRAZIL.

BRAZIL is a red wood, brought from the province of that name in South-America. There are different ſorts of it, diſtinguiſhed by the names of Fernambouc, St. Martha, &c. What differences there are in the trees we know not: The woods, brought to us, differ little otherwiſe than as different parts of one log, ſome pieces being richer in colour than others.

This wood is called by Caſpar Bauhine baſtard Red-ſaunders, *Pſeudoſantalum rubrum ſive arbor Braziliæ*. Many have confounded it with the true Red-ſaunders: The college of Bruſſels, in their account of that wood, have plainly miſtaken the Brazil for it. However the two trees may be allied in their botanic characters, the woods, chemically conſidered, are very obviouſly different; Brazil wood readily giving out its red colour to water, whilſt Saunders gives no red tinge to any aqueous liquor. The watery tincture of Brazil however, is not quite ſo deep as that made in rectified Spirit of Wine, or in volatile alcaline ſpirits.

The ſpirituous tincture ſtains warm Marble of a purpliſh red, which upon increaſing the heat, becomes violet. Mr. du Fay informs us, in a paper upon this ſubject in the French Memoirs, that if the ſtained Marble be covered with Wax and conſiderably heated, it changes through all the ſhades of brown, and fixes at laſt in a Chocolate colour.

The colour of the watery decoction is heightened by Alum, and inclined to a crimſon. A decoction made with Alum, in the proportion of about one part of the Salt to four of the wood, yields upon adding alcaline Ley or volatile ſpirits, a kind of crimſon lake verging a little to violet.

Solution of Tin in Aqua fortis, added to the decoction, throws down a much finer coloured Precipitate, little inferior in beauty to Carmine. This experiment, firſt communicated in the *Acta naturæ curioſorum*, I have ſeveral times repeated with ſucceſs. The quantity of lake is largeſt

TURMERIC. wards with watter three drams and a half, ten drams of earthy matter remaining as before. In diſtillation, pure

WOODS. when Alum is uſed in making the decoction; but the colour is much the fineſt without it.

A tranſparent crimſon for water-colours is ſaid to be made by boiling the wood in ſmall Wort with a little Tartar. A large proportion of Tartar weakens the colour. All acids, if their quantity is conſiderable, have this effect: Thoſe of the mineral kingdom totally deſtroy it.

Brazil wood dyes woollen of a red colour, which does not want beauty, but has little durability. Mr. Hellot gives a pretty remarkable proceſs, by which both the beauty and permanency of the dye are improved. He directs the wood, cut in ſmall pieces, to be boiled in two freſh parcels of the hardeſt well-water that can be procured; the decoctions to be mixed together, and kept in a caſk, till they ferment, grow ſtale, and appear ropy like an unctuous Wine. The cloth is to be boiled for three hours with Alum and Tartar, in the proportion of ſix or eight ounces of the former, and two or leſs of the latter, to every pound, and afterwards kept moiſt, in a cool place, for eight or ten days, that it may be thoroughly penetrated by the Salts. A quantity of the ſtale decoction of Brazil is made to boil in a copper, and ſome common coarſe ſtuff, prepared as uſual with Alum and Tartar, dyed in it: Half as much more of the liquor is then added, and another piece of cloth dyed; ſo as that, between the two, about three fourths of the colour may be taken up. The cloth prepared as above is now to be dipt, and the liquor kept gently boiling, till it has taken the colour uniformly. The red, obtained by this proceſs, is a lively and durable demiſcarlet: On expoſure to the air for four months, in winter, it loſt nothing, but on the contrary became deeper, and ſeemed to gain a body.

The ſame author gives another method of fixing the colour of Brazil by aſtringents: The dyes thus produced are not red, but coffees and purple cheſnuts very beautiful and gloſſy. For this purpoſe, he dilutes the ſtale decoction of Brazil with twice its quantity of water; and adds, for every pound of cloth, about an ounce of powdered Galls, and half an ounce of Gum Arabic. The cloth, prepared with Alum and Tartar, and kept moiſt for fifteen days, is boiled in this liquor for an hour or two, according as the colour is wanted lighter or deeper, and ſuffered to grow thoroughly cold before it is waſhed.

MADDER.

MADDER. MADDER (*Rubia tinctorum ſativa C. B.*) is one of the aſperifolious ſtellated plants, or of thoſe which have rough narrow leaves ſet in form of a ſtar at the joints of the ſtalks. The root, which is the only part made uſe of, is long, ſlender, of a red colour both on the outſide and within, excepting a whitiſh pith which runs along the middle.

This plant was formerly cultivated among us in quantity for the uſe of the dyers, who for ſome time paſt have been ſupplied from Holland and Zealand: Its culture is now again ſet on foot in this kingdom, under the laudable encouragement of a public ſociety. We have formerly obſerved, that the colour of ſome exotic plants, as Alkanet, degenerates in our climate; but this is not the caſe with Madder, the Engliſh Madder being equal to the beſt that is brought from abroad.

Madder-root gives out its colour both to water and to rectified ſpirit: The watery tincture is of a dark dull red, the ſpirituous of a deep bright one, pure ſpirit brings over nothing: The diſtilled water ſmells of the Turmeric, and diſcovers ſome little drops of eſſential Oil.

TURMERIC.

CLASS

one. Taken internally (for it has ſometimes been uſed medicinally as an aperient and diuretic) it tinges the urine red. In the Philoſophical Tranſactions, and in the Memoirs of the French Academy, there are accounts of its producing a like effect upon the bones of animals, to whom it had been given with their food: All the bones, particularly the more ſolid ones, were changed both externally and internally to a deep red, but neither the cartilaginous or fleſhy parts ſuffered any alteration. Some of theſe bones, macerated in water for many weeks together, and afterwards ſteeped and boiled in Spirit of Wine, loſt nothing of their colour, nor communicated any tinge to the liquors.

MADDER.

The dealers in this commodity make three ſorts of it: Madder in the branch, Madder in the bunch or in the bundle, and Madder unbundled. Madder *in the branch* is the entire root dried: This, ground in mills into a groſs powder, is the *unbundled* Madder: The *bundled* or *bunch* Madder is a powder of the finer roots, freed from the outer bark and from the pith. It is ſaid that by keeping for two or three years, in cloſe caſks, the colour is improved; in open veſſels it decays.

Madder imparts to woolen-cloth, prepared with Alum and Tartar, a very durable, though not a very beautiful red dye. As it is the cheapeſt of all the red drugs that give a durable colour, it is the principal one commonly made uſe of for ordinary ſtuffs. Sometimes its dye is heightened by the addition of Brazil-wood; and ſometimes it is employed in conjunction with the dearer reds, as Cochineal, for demiſcarlets and demicrimſons. Mr. Hellot (from whoſe *Art de teindre* the remaining part of this note is extracted) informs us that thoſe who dye the beſt Madder reds are particularly careful to keep the liquor of a heat conſiderably below boiling, increaſing the fire only towards the end, ſo as to make it boil for a minute or two juſt before the cloth is taken out, to confirm the dye. A boiling heat enables water to extract not only the red but a tawny or browniſh matter, which debaſes the red to a dull brick colour.

The proportion of Madder is about half the weight of the cloth. The beſt proportion of Salts for preparing the cloth to receive the dye, ſeems to be, five parts of Alum and one of red Tartar, for ſixteen of the ſtuff; which is to be boiled with theſe for two hours or longer, then kept moiſt for ſome days, and afterwards digeſted with the Madder.

A variation in the proportion of the Salts varies the colour communicated by the Madder; and not only the ſhade but the ſpecies of colour. If the Allum be diminiſhed and the Tartar increaſed, the dye proves a red Cinnamon: If the Allum be entirely omitted, the red is deſtroyed, and a very durable tawny Cinnamon is produced.

On boiling the dyed cloth in weak alcaline Ley, great part of the colour is deſtroyed, and the remainder appears of a dirty or a kind of ſallow hue: Solution of Sope, on the other hand, diſcharges a part, and leaves the remaining red more lively than before.

Volatile alcalies heighten the red colour of Madder, but at the ſame time render it fugitive like themſelves: Madder prepared with Lime and Urine, after the manner practiſed for Archil, loſt its red colour on attempting to dye with it, and communicated to the cloth only permanent nut colours.

If a pure red, as that of Cochineal, be applied on cloth which has been previouſly dyed blue, and afterwards prepared for receiving this red by boil-

CLASS IV.

UNCTUOUS VEGETABLES.

UNCTUOUS VEGETABLES.

UNDER this diviſion are included thoſe vegetables which abound with a groſs, inodorous, inſipid Oil, ſeparable by expreſſion; as Almonds, the kernels of moſt fruits, and many kinds of ſeeds. An Oil of the ſame kind appears to be contained in all vegetable matters, though it cannot be ſeparated from all in its proper form: All vegetables yield an empyreumatic Oil on being diſtilled by a ſtrong fire; and this ſeems to be no other than the native Oil of the ſubject, rendered ſubtile, acrid and empyreumatic by the heat.

ALMONDS.

THERE are two kinds of ALMONDS, ſweet and bitter; and ſome varieties of each of theſe, proceeding from the ſoil and climate. The tree which bears the common ſweet Almonds is called by Tournefort and Caſpar Bauhine *Amygdalus ſativa*; and that which produces the bitter, *Amygdalus amara*. They both reſem-

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MADDER.

boiling with Alum and Tartar, a purple or violet will be produced, according as the blue or the red prevail. The Madder red has not this effect; for as its colour is not a pure red, but is tarniſhed by the tawny matter which its woody fibres have in common with other roots; it gives upon blue only a cheſnut dye, more or leſs deep according to the deepneſs of the blue applied firſt.

There are however means of obtaining from Madder a fine purple, without the addition or any colouring drug. A piece of white woolen cloth, weighing half an ounce, was boiled for half an hour with ten grains of Roman Allum, and ſix grains of Tartar, and then taken out, ſqueezed, and ſuffered to cool. Twenty four grains of bunch Madder were added to the ſame liquor; and after the Madder had given out its colour, twenty drops of a ſolution of Biſmuth (made in Spirit of Nitre diluted with equal its weight of water) were dropt in. The cloth was now dipt again, and in half an hour taken out, ſqueezed, and waſhed: It appeared of a crimſon colour, nearly as beautiful as if it had been dyed with Cochineal. To try the effect of loading it further with the colouring matter, it was returned into the liquor and boiled for a quarter of an hour longer: It had now acquired a purple colour ſufficiently vivid.

On varying this experiment, by keeping the cloth moiſt for ſome days after the preparation with Alum and Tartar, then dipping it in a plain decoction of Madder made as uſual without Salts; and adding, when it had gained a bright Cinnamon colour, the ſame ſolution of Biſmuth, the dye, inſtead of a purple, proved only a cheſnut.

ble the Peach-tree in the leaves and flowers, but grow to a much larger ſize: It is obſerved, that they do not well bear being tranſplanted. The greateſt quantities of Almonds are produced in Syria, Barbary, Turkey, Spain, Italy, the iſland of Cyprus, and France. The German ſhops are ſupplied chiefly from Provence and Valencia. In England, three ſorts of Almonds are diſtinguiſhed; ſmall Barbary Almonds, Long Jordan Almonds, and ſhort, broad, Spaniſh or Valencia Almonds. **ALMONDS.**

Sweet Sweet Almonds conſiſt chiefly of expreſſible Oil and a fine farinaceous earth: The Oil is ſo plentiful, and ſo looſely intermixed with the other principles, that a part of it may be ſqueezed out with the fingers. The medical uſes of ſweet Almonds are, to ſoften and obtund acrimony, and to render reſinous ſubſtances ſoluble in water and in the animal fluids. The Reſins of Jalap, Scammony, and others, triturated with Almonds, diſſolve in water into an emulſion, and in this form operate effectually, without producing the violent gripes and other dangerous conſequences, which they never fail to do when given by themſelves The Oil is an excellent medicine in cholicky and nephritic pains: Half an ounce may be taken for a doſe, with thirty drops of the mineral anodyne liquor.

Bitter. Bitter Almonds yield alſo an Oil to the preſs, not bitter like the Almonds themſelves, but as taſteleſs as that of the ſweet kind, all the bitter matter remaining in the cake left after the expreſſion. I have made ſundry experiments for determining in what principle the bitterneſs reſides; but they have not anſwered ſo perfectly as could be wiſhed. The Almond-cake was diſtilled both with pure water, and with water and Salt, and with highly rectified Spirit of Wine. The diſtilled waters were ſcarcely bitter, but ſmell a little of Almond, and had a conſiderable pungency: The diſtilled ſpirit diſcovered ſcarcely any pungency or bitterneſs, and differed very little in ſmell or taſte, from the pure ſpirit employed: Greateſt part of the bitterneſs, in all the diſtillations, was left behind, and continued in the inſpiſſated extracts (*k*.) Bit-

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(*k*) *Bitter Almonds.*] Great part of the bitter matter diſſolves, by digeſtion, both in watery and in ſpirituous liquors; and a part ariſes with both

ALMONDS. Bitter Almonds are poiſonous to animals that come into the world blind, particularly to birds. In the human body, they act as reſolvents and aperients. Sweetened with Sugar, or made into an emulſion, they are an uſeful diuretic, and an anthelmintic for children. If taken freely they occaſion ſickneſs or vomiting.

THERE are ſundry other ſubſtances from which groſs Oils are commonly extracted in large quantity for mechanic uſes, and which it were needleſs to examine in particular, as they have no other remarkable qualities than thoſe which depend upon the Oil, and as the principal differences of theſe kinds of Oils have been already mentioned. See p. 64.

CLASS V.

Vegetables whoſe prevailing principle is an eſſential Oil.

OILY VEGETABLES. MANY of the ſubſtances of this claſs yield but a very ſmall quantity of eſſential Oil: Nevertheleſs, in this Oil reſides the whole of their diſtinguiſhing ſmell and taſte. On diſtilling them with water, all the active parts of the ſubject ariſe, partly impregnating the liquor, and partly ſeparating in their proper oily form: On inſpiſſating the remaining decoction, a mucilaginous extract is left, which, if not altogether inſipid, has at leaſt nothing of the ſpecific taſte any more than of the ſmell or flavour of the original vegetable. Rectified Spirit of Wine frequently elevates little or nothing in diſtillation, the Oil remain-

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both in diſtillation. Spirit ſeems to diſſolve, and water to elevate moſt; but it did not appear that the whole is diſſolved or elevated by either, or by the alternate application of both. It is chiefly, if not ſolely, in the matter which ariſes in diſtillation, that the noxious qualities of the bitter Almonds reſide. A water diſtilled from them, when made of a certain degree of ſtrength, has been found from experiment to be poiſonous to brutes; and there are inſtances of cordial ſpirits flavoured with them being poiſonous to men. In theſe preparations the active principle has its activity probably increaſed, by its ſeparation from the ſoft inſipid Oil and the farinaceous matter with which it was combined in the kernel itſelf. The kernels of other fruits that have any bitterneſs or particular flavour, appear to be impregnated with a ſubſtance ſimilar in quality to this poiſonous principle of bitter Almonds.

OILY VEGETABLES.

ing in the extract blended with the reſinous parts: If this extract is boiled with water, the volatile Oil is diſſipated as before, and only an inſipid and inodorous reſinous maſs is left. To this claſs belong ſome of the flavourleſs pungent ſubſtances, as Horſe-radiſh and Muſtard-ſeed; ſome ungrateful pungents, as Garlic; ſome of the aromatic plants, as Roſemary and Aniſe; and ſome of the foreign ſpices as Nutmegs.

I. HORSE-RADISH.

HORSE-RADISH (*Raphanus ruſticanus, armoracia*, the *Cochlearia folio cubitali* of Tournefort) is a root of common and well known uſe at table; but its chemical ſtructure, the principle in which its pungency reſides, and which ſo ſtrongly affects the organs of taſte and ſmell, have been hitherto wholly unknown.

The very ſoul of Horſe-radiſh is an eſſential Oil, which is ſo ponderous as to ſink in the aqueous fluid that comes over with it: A conſiderable part however is imbibed by the water, ſo as to communicate a ſtrong impregnation: It is highly pungent, but not fiery or hot like moſt other eſſential Oils; as ſoon as the firſt impreſſion of pungency is over, it leaves an agreeable ſweetiſhneſs upon the tongue. It is on account of the avolation of this ſubtile Oil, along with the native watery moiſture of the root, that Horſe-radiſh loſes its pungency in drying: The entire root may be preſerved freſh in a cool place, eſpecially if covered with ſand, for a conſiderable time; but if the outer ſkin be taken off, the root ſliced or ſhaved, and laid in a moderately warm place, its activity is quickly diſſipated, and in this ſtate it will not yield a ſingle drop of Oil.

Eight ounces of the freſh root were reduced by drying to two ounces two ſcruples. Water extracts from this quantity one ounce of mucilaginous matter, and ſpirit takes up from the reſiduum fifteen grains of Reſin. The eſſential Oil amounts to nearly the ſame proportion, beſides what remains diſſolved in the diſtilled water. Rectified ſpirit, applied at firſt, takes up ſeven drams from eight ounces, and water extracts afterwards near three drams. Both the extracts are ſomewhat ſweetiſh, the ſpirituous moſt ſo. It has

been

Horse-radish. been ſaid that the pungency of Horſe-radiſh is covered by trituration with Almonds; but this did not anſwer upon trial.

II. Garlic. GARLIC (*Allium ſativum* C. B.) is a plant of the Leek kind, cultivated in gardens: It has long, not tubulous leaves, and produces a ſpherical cluſter of hexapetalous Lily-like flowers, each of which is followed by a roundiſh ſeed veſſel. The only part made uſe of is the root; which conſiſts of a number of white, coated bulbs, incloſed in a purpliſh-red ſkin, with a buſh of fibres at the bottom: Such roots ſhould be choſen as are not very tough or compact.

Garlic has a ſtrong ſmell, and a ſharp biting taſte. In many places, it is employed in foods and ſauces: The Eaſtern nations are particularly fond of it. As a medicine, it is a powerful reſolvent and attenuant; and hence of good ſervice where the breaſt, ſtomach or inteſtines, are obſtructed or overloaded with viſcid phlegm. Some have held it a ſpecific in the gout; and imagined, that it is the plentiful uſe of this root, which preſerves the Jews from that diſorder. Uſed as a ſuppoſitory, it occaſions a ſurpriſing paleneſs and ſicklineſs of the face.

The ſmell of Garlic is to many people unſupportable. There are ſundry ſubſtances which have been ſaid to take off both its ſmell and taſte, as Cloves, Cinnamon, Calamus aromaticus, Cardamom-ſeeds, Zedoary and Rue. On trial, none of them was found to anſwer: They weaken or overpower the ſmell of the Garlic, more or leſs in proportion to their own quantity, but do not effectually conceal it. Zedoary and freſh Rue cover the ſmell more than any of the others, and the Rue ſomewhat more than the Zedoary. The ancients pretended that ſpiders had ſuch an averſion to the ſmell of Garlic, that if incloſed in a circle of the roots, they would be unable to get over it: This alſo I have tried, and found to be falſe. It is obſervable, that Arſenic and the Phoſphorus of Urine ſmell like Garlic: Wherever we perceive an alliaceous ſmell, if no plant of the Garlic kind be there, we may be ſure that it proceeds from an arſenical matter.

Many have imagined that Garlic abounds with volatile Salt, and that this is the cauſe of its ſtrong ſmell. Experiments have ſhewn, that the ſmell of Garlic reſides in a very different principle, and that the conſtituent parts of this root are the following. (1.) A large quantity of watery moiſture, amounting to nearly two thirds of its weight; for two ounces of the freſh root were reduced by drying to five drams two ſcruples. We cannot ſeparate ſo much liquid matter by expreſſion; four ounces of the freſh root yielded ſcarcely one ounce of juice: But nearly all that is loſt in drying may be collected by diſtillation. (2.) A conſiderable quantity of mucilaginous or gummy matter. Two ounces of the root being infuſed and boiled in water, in a glaſs body cloſely covered, and the water renewed ſo long as it continued to extract any thing from the root; the ſeveral infuſions, mixed and filtered, yielded on inſpiſſation, ſix drams and a ſcruple of gummy extract. (3.) A ſmaller proportion of unctuous reſinous matter. Two ounces, cut in pieces, and digeſted in freſh parcels of highly rectified Spirit of Wine, yielded on inſpiſſating the tinctures, only two drams and three grains of reſinous extract: This unctuous, tenacious, reſinous ſubſtance, diſcovers itſelf alſo during digeſtion, being very apt to precipitate and ſtick to the veſſel: To this are owing the precipitations which juice of Garlic occaſions in ſome metallic ſolutions, and which have been erroneouſly aſcribed to a ſaline principle. That the reſinous part is in leſs quantity than the gummy, appears further from hence; that rectified ſpirit, digeſted on the matter left by water, takes up only one ſcruple and ſeven grains; but water digeſted on the matter left by ſpirit, took up two drams, two ſcruples and two grains. (4.) An indiſſoluble earthy matter, amounting in either method of extraction, to two ſcruples and one or two grains upon two ounces. (5.) The fifth and principle ingredient, the very ſoul of the Garlic, is an eſſential Oil. In this alone reſides the ſmell, and the taſte, and all that diſtinguiſhes the Garlic.

GARLIC.

GARLIC. The quantity of Oil is ſmall, but its activity, and penetrancy are ſo much the greater: Its ſmell is abominably ſtrong. On diſtilling with water thirty-two ounces of the root, ſcarce half a dram of Oil could be collected: It is quite ropy and thick, and difficultly ſeparable from the aqueous fluid: The water diſtilled off in making the watery extract after ſpirit, diſcovered alſo a conſiderable ſmell, but of a fetid kind different from that of Garlic——A diſtilled ſpirit and ſaturated tincture are recommended by ſome as preſervatives againſt peſtilential infection. From the alexipharmac virtues attributed to this root, it has received the name of *Theriaca ruſticorum*.

III. ONIONS. THE common ONION (*Cepa vulgaris* C. B.) is another root, whoſe characteriſtic principle has been hitherto unkown. It is remarkable of the Oil of this root, that it remains all diſſolved in the diſtilled Water, which it impregnates with an exceſſively ſtrong ſmell: On diſtilling twelve pounds of Onions, peeled and cut in pieces, I could not ſeparate any Oil, though all the active parts of the root were collected in the Water.

This root contains a large quantity of aqueous moiſture; Eight ounces were reduced by drying to eight drams and a half. The matter diſſipated in the exſiccation was chiefly Water, with a little of the more ſubtile part of the Oil. The Onions when about half dry, ſmelt like Rue.

An ounce of the dry root yielded with rectified Spirit ſix drams of extract, and afterwards with water one dram eighteen grains: Another ounce, treated firſt water, gave ſix drams thirty-five grains, and afterwards with Spirit half a dram: The indiſſoluble reſiduum weighed in the firſt caſe two ſcruples ſixteen grains, in the latter eight grains more. The diſtilled Spirit is ſomewhat impregnated with the Oil of the Onion, diſcoverable rather by its taſte than by its ſmell; the more ſubtile odorous parts having been diſſipated in the previous exſiccation. The ſpirituous extract taſtes ſtrongly of the Onion: This is the ſtrongeſt preparation in point of taſte, and the diſtilled Water in ſmell——

ONIONS. This root, beſides its culinary uſes, has been employed medicinally as a reſolvent and diuretic, in cachexies, dropſies, nephritic caſes, &c.

IV. MASTER-WORT. THE roots of MASTERWORT, *Imperatoria, Aſtrantia, Oſtrutium,* (*Imperatoria major C. B.*) have a pungent, aromatic taſte, and a very ſtrong, agreeable ſmell. They are long, unequal, of a brown colour without and a yellowiſh-white within, full of greeniſh-yellow ſpecks, particularly towards the outſide, of a ſparkling manifeſtly reſinous appearance, and unctuous to the touch.

The diſtinguiſhing taſte as well as ſmell of the root reſides in an eſſential Oil, which is ſmall in quantity but of great activity: Sixteen ounces ſcarcely afford more than half a dram. The diſtilled ſpirit ſmells a little of the root, but not near ſo ſtrongly as the diſtilled water, pure ſpirit elevating only ſome of the more ſubtile parts of the Oil. The ſpirituous extract on the other hand is much ſtronger than the watery, the latter having loſt in the evaporation all the Oil or ſpecific matter of the Maſterwort, of which greateſt part is retained by the former. An extract made by ſpirit after water is a mere groſs inſipid Reſin; and an extract made by water after ſpirit is merely mucilaginous.

An ounce of the root gave four drams ten grains of watery, and afterwards half a dram of ſpirituous extract: Rectified ſpirit applied at firſt extracted from the ſame quantity two drams and a half, and water afterwards five ſcruples: The indiſſoluble earthy part weighed in the firſt caſe three drams twenty grains, in the latter three drams fifty grains.

V. ANGELICA. THE roots of ANGELICA are nearly ſimiliar in quality to thoſe of Maſterwort: They have a pungent, agreeable, bitteriſh taſte, and a ſtrong aromatic ſmell, ſomewhat of the muſky kind. Their activity reſides in an eſſential Oil and a reſinous matter: The Oil is obtained by diſtillation with Water: On digeſting or infuſing the roots in Spirit of Wine or in Water, both the Oil and Reſin are extracted, wholly by the former, and in part by the latter.

ANGELICA.

Theſe roots, like thoſe of moſt of the umbelliferous plants, are very apt to be preyed upon by Worms, to become carious, and fall into powder. So long as they are but merely worm-eaten, and not powdery, they are as fit for making the eſſential Oil, or the ſpirituous tincture and extract, as in their moſt perfect ſtate; and even more ſo; the inſects preying firſt, not upon the reſinous and oily, but on the earthy and mucilaginous parts: When ſuch roots are made uſe of, care muſt be taken to beat out as much as poſſible, the worms and duſt. The beſt method of preſerving Angelica for any conſiderable length of time, is, to dry it thoroughly, then pack it up cloſe in glaſs or other compact veſſels; which are to be carefully ſtopt ſo as to prevent the admiſſion of air, and kept in a dry place.

VI. ANISEED.

THE moſt active part of Angelica is the root; of ANISE, the ſeeds. Aniſeed contains, beſides its eſſential odorous Oil, a groſs one of the expreſſible kind: The eſſential Oil, and the ſmell and taſte of the ſeeds which depend upon it, are confined to the outer thin ſkin: The inner kernel which is commonly divided longitudinally into two portions, has little or no ſmell, and exceeding little taſte: In this reſides the groſs Oil, naturally inodorous, and inſipid, but which nevertheleſs, in its ſeparation from the ſeed by the preſs, brings with it a part of the eſſential Oil, ſo as to become ſtrongly impregnated with the peculiar flavour of the Aniſeed: Its colour is greeniſh.

The eſſential Oil, though mild in taſte, has an extremely ſtrong ſmell, which it communicates to whatever it touches, in ſuch a degree, as ſcarcely or not at all to be overpowered. It coagulates in the cold, becoming thick like butter, a property obſerved in very few of the eſſential Oils: The coagulation is generally aſcribed to its being diſtilled by a ſtrong fire; but I have drawn from Aniſeeds, by a bare digeſting warmth, an Oil which coagulated even in ſummer. The addition of a little common Salt is of Service in the diſtillation of the Oils of many vegetables: But for Oil of Aniſeed, that addition is by no means to be employed; this ſeed yielding only half as much Oil when

diſ-

ANISEED.

diſtilled with Salt, as it does without. This Oil is drawn in large quantity about Magdeburg, and is in general greatly adulterated. We may ſometimes buy an ounce of the Oil for nearly the ſame price as a pound of the ſeeds; though a pound of the ſeeds yields only about half an ounce, and the reſiduum is of no uſe. It is remarkable of this Oil, that it diſſolves Sulphur in greater quantity than any other Oil, expreſſed or diſtilled: Digeſted with a compoſition of Sulphur and fixed alcaline Salt, it imbibes a large portion of Sulphur from the alcali, ſo as to acquire a thick conſiſtence, whilſt other diſtilled Oils take up very little, and expreſſed ones ſcarce any.

VII.
STELLATED ANISE.

AN exotic fruit, compoſed of ſeven or eight, and ſometimes nine capſules ſet in form of a ſtar, is diſtinguiſhed in the ſhops by the name of *Aniſum ſtellatum*, Stellated or STARRY-HEADED ANISE; its taſte and ſmell being exactly ſimiliar to thoſe of the common Aniſeeds, but ſtronger. This fruit is called by ſome *Aniſum Indicum*, *Chinenſe*, *Ruſſicum*, *Moſcoviticum*, *Peregrinum*, *Philippinarum inſularum*, *Semen badian*, *Fæniculum ſinenſe*, *Cardamonum ſiberienſe*. Of the plant which produces it we have no account, except that Cluſius deſcribes and figures a ſmall branch received from the Philippine Iſlands with ſome of the fruits upon it: It is commonly ſuppoſed that this fruit, and the wood called in Holland from its ſmell Aniſe-wood, are taken from one tree.

The ſtarry capſules are ſomewhat broad at the end where they are joined, and pointed at the oppoſite one; externally hard, rugged, unequal, and of a reddiſh brown colour like ruſt of Iron; internally ſmooth and gloſſy: They commonly open on the upper ſide, and diſcover an oblong kernel, about the ſize of Colocynth-ſeeds, covered with a ſmooth browniſh ſkin ſomewhat darker than that of Linſeed, internally yellowiſh and brittle. Herman relates, that the ſmell and taſte of this fruit is confined wholly to the outer capſules, the kernels having none. The ſkin of the kernel has indeed neither taſte nor ſmell, but the inner ſubſtance is in both reſpects ſtronger than the capſules; and in

STELLATED ANISE.

theſe particulars the ſtellated Aniſe differs remarkable from the common.

To determine this point more ſatisfactorily, I diſtilled equal quantities of the kernels and of the capſules, with equal quantites both of rectified Spirit of Wine and of Water: The diſtilled liquors were nearly equal in degree of ſmell and taſte, but in the diſtillations with Water, a good deal more Oil was obtained from the kernels than from the capſules; a ſure proof that the former is the moſt active part. The kernel contains alſo an expreſſible Oil, like the common Aniſeeds; but as this Oil is lodged in the ſame part, and naturally blended, with the eſſential, it proves, when ſeparated from the ſeed by expreſſion, very ſtrongly impregnated with its taſte and ſmell.

The ſtellated Aniſe is applicable to the ſame purpoſes as the common: It is uſed chiefly, in the form of tincture, and of a watery infuſion or tea, as an expectorant, carminative and ſtomachic.

VIII. SMALLAGE.

SMALLAGE, *Apium*, *Apium paluſtre*, *Paludapium*, *Eleoſelinum*, is an umbelliferous plant, growing wild in marſhy places. The Garden-celery, of common uſe in food, is ſuppoſed to be no other than the wild Smallage improved by culture.

SEEDS.

The moſt active part of Smallage appears to be the Seeds. Theſe, like moſt of the ſeeds of umbelliferous plants, contain two kinds of Oil, an eſſential one in which their diſtinguiſhing flavour reſides, and an expreſſible one of little ſmell or taſte: The firſt is lodged in the ſhell, the other in the kernel of the ſeed. Sixteen ounces of Smallage-ſeeds yield about two ſcruples and a half of eſſential Oil. One ounce of the ſeeds afforded, with Water, three drams two grains of gummy extract, and afterwards with rectified Spirit, twenty-four grains of Reſin: Another ounce treated firſt with Spirit, gave five ſcruples ſix grains of reſinous, and afterwards with Water two ſcruples ſeventeen grains of gummy extract. It is remarkable, that the reſinous extracts are of a fine green colour.

Fifty-ſeven ounces of the freſh leaves of Smallage yielded on expreſſion thirty-four ounces of juice; from which

SMALLAGE.

which were obtained, by a tedious cryſtallization, one dram and a few grains of a ſolid concrete ſlightly ſaline to the taſte, very difficultly ſoluble in Water, and which laid upon burning coals appeared more of the earthy than ſaline kind. Of the dry leaves, about one half is earthy or indiſſoluble: An ounce yielded with Water three drams forty-ſix grains of gummy extract, and afterwards with Spirit ſcarce half a dram of a reſinous one: Another ounce, treated firſt with Spirit, gave two drams two ſcruples and a half of reſinous, and afterwards one dram ſeventeen grains of gummy extract. In diſtilling a large quantity of the leaves with Water, a ſmall portion of eſſential Oil is obtained; but none could be collected on diſtilling an ounce.

Roots.

An ounce of the dried roots yielded half an ounce of watery, and afterwards half a dram of ſpirituous extract: Another ounce, on inverting the order of applying the menſtrua, gave a dram and a half of ſpirituous, and three drams of watery extract——With regard to the medical virtues of this plant, the roots are accounted aperient, and the ſeeds carminative.

CICUTA AQUATICA.

THERE is a poiſonous plant, greatly reſembling Smallage, growing in the ſame places, and which has too often been fatally miſtaken for it: The ſtalks, the flowers, the ſeeds, the roots, the juice, the ſmell and the taſte, are in both plants alike, and only the leaves different. The poiſonous herb appears to be but imperfectly known: The botaniſts themſelves have referred it to many different genuſes, ſome to that of *Apium*, ſome to *Anagallis*, others to *Phellandrium*, *Œnanthe*, *Myrrhis*, *Cicuta*, *Cicutaria*, *Petroſelinum*, *Aconitum*, *Sium*: Some give it the ſame name with Smallage, *Apium paluſtre*, or *aquaticum*. A certain phyſician of Regenſpurgh, who ſome years ago opened a ſtudent that had been killed by it, calls it *Aconitum cæruleum petroſelinoide, odore Angelicæ, radice ireos ſimili, Caſp. Bauh. pin.* but unfortunately no ſuch name is to be met with in the writings of Caſpar Bauhine, or any other Botaniſt.

CICUTA AQUATICA.

The poiſonous plant is the *Sium erucæ folio* of Caſpar and John Bauhine, *Sium alterum* of Dodonæus, the *Sium alterum oluſatri facie* of Lobel, who has given the moſt diſtinct figure, the *Sion aquaticum, rugoſis foliis trifidis, multifidis & dentatis* of Moriſon, the *Cicuta aquatica* of Geſner, the *Sium paluſtre alterum foliis ſerratis* of Tournefort, *Cicutaria* of Rivinus, *Sium majus alterum anguſtifolium* of Parkinſon, and *Sium majus anguſtifolium* of Tabernæmontanus. It is called in Saxony *Bartzen-kraut*, about Berlin *Berſte-kraut* (a name applied alſo to other poiſonous plants) in the Netherlands *Træ ede Water-eppe*, in Italy *Gorgoleſtro*, in Spain *Rabacas*, and in England LONG-LEAVED WATER-HEMLOCK.

It differs from Smallage in the leaves being long, ſlender and deeply cut, commonly into three ſegments. Thoſe of Smallage are cut in the ſame manner, but the ſegments are ſhort and broad. The roots of this plant are at firſt hollow and green, and lined internally with a ſhining white matter: By age they become harder and more ſolid, and change their green colour to a pale yellowiſh: When full grown, they are as large as the fiſt They have a number of fibres, like the common Celery-root, eſpecially at the bottom, by which they are faſtened to the earth, at the bottom of the Water wherein they are commonly produced: They are often however looſened and carried off by the Water; and too often have been taken up and eaten for Celery, of which a melancholly inſtance happened in this neighbourhood [Berlin] ſome years ago: Their taſte and ſmell are the ſame, except that the ſmell is more penetrating, and that after the firſt agreeable taſte is over, ſomewhat biting is left upon the tongue.

Their poiſonous quality reſides in an orange-yellow juice, which is diſtributed indeed through the whole plant, but accumulated moſt plentifully in the roots. I took an old, yellowiſh, juicy root, and paring off the outer part which abounds moſt with juice, preſſed out ſome of the yellow liquor: A little of this, mixed with ſome portion of the root in ſubſtance cut ſmall, being given to a ſtrong young dog, he was in two min-

CICUTA AQUATICA.

minutes ſeized with violent convulſions: He then begun to vomit exceſſively, but was not relieved; In nine minutes he died. I know of no poiſon ſo active and ſo ſudden, excepting the ſubtile fumes which fly off from fermenting liquors, and the vapour of burning Charcoal confined: The moſt violent of the mineral poiſons, Arſenic and Corroſive-Sublimate, are not equal to it. In a few minutes it brings on high convulſions, loſs of the ſenſes, raving, ſwelling of the eyes, inflammations, death: On diſſection, the ſtomach is ſometimes found corroded, the heart flaccid, blood extravaſated, the teſticles of a purple and blackiſh red colour: In others, there was ſcarcely any thing præternatural to be obſerved. See Wepfer's treatiſe *De Cicuta Aquatica.* The only means of preventing the terrible effects of this poiſon, are immediate vomiting, not by acrid medicines, but by taking large quantities of Milk, Oil, Fats, and if theſe fail, ſome Ipecacoanha or other mild emetic: Glyſters of Water, Milk, or Water-gruel, with Oil or butter, are alſo to be repeatedly injected; and gentle diaphoretics ſubjoined.

The young roots, as containing leſs of the yellow juice, are leſs dangerous than the old: The juice of a young green root being given to a dog, he ſoon fell down, and appeared in great pain, but after vomiting ſeveral times, he grew better, and in a few days was well. By drying, the poiſonous quality is greatly abated, if not totally deſtroyed.

On a chemical analyſis, both the leaves and roots of this plant are found to contain a large quantity of watery moiſture. Four ounces of the freſh roots were reduced by drying to three drams and a half; from which were obtained two drams of ſpirituous and half a dram of watery extract; only one dram of earthy matter remaining from the whole four ounces. The leaves loſt more in drying, and yielded leſs earth than the roots: The quantity of watery extract was two drams from four ounces: The reſiduum gave but half a ſcruple to Spirit. Sixteen ounces of the leaves yielded in expreſſion ten ounces of juice;

CICUTA AQUAT. which, on being inſpiſſated, left no more than a ſcruple of ſolid matter.

IX. FENNEL COMMON. COMMON FENNEL SEED (*Fœniculum vulgare Germanicum C. B.*) is of a fine greeniſh colour, and an oval figure with ſeveral longitudinal furrows: Every ſeed parts longitudinally, when dry, into two. It has a ſtrong aromatic ſmell and taſte, ſomewhat like thoſe of a mixture of Aniſe and Dillſeeds with a little Angelica: To thoſe ſeeds alſo it is nearly ſimilar in medicinal virtue.

It contains a portion of expreſſible, as well as an eſſential Oil; the ſpecific qualities of the ſeed reſide in the latter, which has a ſtrong penetrating ſmell, but is not very ſubtile or volatile, for pure rectified Spirit of Wine carries up in diſtillation exceeding little of it. A conſiderable portion of oily matter ſeparates during the inſpiſſation of the ſpirituous tincture of the ſeeds; the Oil flowing at top, whilſt the more purely reſinous parts fall to the bottom.

On inſpiſſating a tincture drawn from two ounces of bruiſed Fennel-ſeeds, the pure reſinous extract amounted only to four ſcruples and four grains, and the Oil to two drams: Both the Oil and the Reſin were of a fine green colour. This extract ſmelt and taſted exceeding ſtrongly of the Fennel, little or nothing of its flavour having been diſſipated in the evaporation, and though a part was imbibed by the groſs Oil, yet much remained ſtill in the extract. The reſiduum of the ſeeds yielded with water two drams of mucilaginous extract, leaving undiſſolved ten drams and a ſcruple of earthy matter.

The ſame quantity of the ſeeds, digeſted and boiled firſt with Water, gave four drams and a ſcruple of a mucilaginous extract; after which, rectified Spirit extracted one dram of Reſin; the reſiduum amounting, as before, to ten drams and a ſcruple. In diſtillation with Water, about a ſcruple of eſſential Oil was obtained from two ounces. The firſt watery extract had very little taſte: That made after Spirit was ſomewhat bitteriſh: The ſpirituous extract, made after Water, could not be reduced to a dry conſiſtence

FENNEL. on account of the groſs Oil that was blended with it: To the taſte it was diſagreeably oily.

The leaves of Fennel are nearly ſimilar in flavour to the ſeeds, but leſs grateful. They yield in diſtillation a ſmall quantity of eſſential Oil: That obtained from the upper leaves is remarkably finer, lighter, and more ſubtile than that of the lower: One ſwims on Water, whilſt the other ſinks.

The root is about the thickneſs of the finger, commonly ſtreight, of a whitiſh colour with a woody pith in the middle. It has a ſweetiſh aromatic taſte and ſmell, and is ſuppoſed to poſſeſs an aperient virtue.

and Sweet. Sweet Fennel (*Fœniculum dulce C. B.*) is raiſed chiefly in Italy. The ſeeds are larger than thoſe of the common ſort, and of a ſweeter and more agreeable taſte: Their diſtilled Oil alſo is conſiderably more grateful. In other reſpects they agree nearly with thoſe of the foregoing ſort. The roots of this ſpecies are uſed by the Italians in food.

X. CHERVIL. CHERVIL (*Chærophyllum ſativum C. B.*) is a culinary herb, of a ſlightly aromatic taſte, and not a diſagreeable ſmell: It is ſaid to be diuretic, and of great ſervice in dropſies.

It contains a large quantity of watery moiſture: Sixteen ounces of the freſh leaves were reduced by drying to one ounce ſeven drams. Diſtilled with water, it gives over an eſſential Oil, ſmall in quantity, but poſſeſſing all the activity of the herb: From nine pounds I did not obtain quite half a dram; part was colourleſs and ſwum on the water; part was of a yellowiſh-brown colour and ſunk. I have gained alſo from ſundry other vegetables two kinds of Oil in one operation; a point which has not hitherto, that I know of, been conſidered, or indeed obſerved by any. It is commonly ſuppoſed, that only the Indian ſpices yield an Oil ſo heavy as to ſink in water.

The Oil of Chervil, even that which ſwims, is not very volatile, for rectified ſpirit brings over nothing of it: A conſiderable part of it, however, is diſſipated in drying along with the watery moiſture of the herb, and elevated in diſtillation by a phlegmatic ſpirit:

CHERVIL. Hence the ſpirituous extract made either from the freſh or dry leaves, has but little of the flavour of the Chervil; for when freſh leaves are uſed, their watery moiſture, rendering the ſpirit phlegmatic, enables it to carry up the Oil.

From an ounce of dry Chervil were obtained three drams and one ſcruple of watery, and afterwards three drams of ſpirituous extract. On inverting the order of applying the two menſtrua, I gained, from the ſame quantity three drams ten grains of ſpirituous, and afterwards a dram and a half of watery extract.

The ſeeds of this plant diſcover no conſiderable taſte or ſmell, either in ſubſtance, in their diſtilled water or ſpirit, or in their extracts. An ounce gave a dram and a half of watery, and thirty-four grains of ſpirituous extract: Another ounce, treated contrariwiſe, gave only thirty-two grains of ſpirituous, and one dram thirty-three grains of watery extract.

XI. BETONY. BETONY (*Betonica purpurea C. B.*) has very little taſte or ſmell; but what it has, reſides in an eſſential Oil, as being elevated by water in diſtillation, though we can ſcarcely obtain any ſeparable Oil upon diſtilling a moderate quantity of the herb.

This Oil does not ariſe with rectified ſpirit, and hence the ſpirituous extract has a conſiderable taſte, whilſt the watery is almoſt inſipid. The ſpirituous extractions poſſeſs the green colour of the plant, whilſt the watery have nothing of it; and indeed vegetable greens in general ſeem to reſide in a reſinous matter, or at leaſt in a ſubſtance that is ſoluble in Spirit of Wine and not in water.

An ounce of the dry leaves of Betony yielded with rectified ſpirit three drams two ſcruples, and afterwards with water two drams one ſcruple of extract: Another ounce, treated firſt with water gave five drams, and afterwards with ſpirit one; ſo that whichſoever of theſe menſtrua is firſt applied, ſix drams are extracted, and two drams left.

This plant has been celebrated for abundance of medicinal virtues, but does not promiſe to have any conſiderable activity: Its principal uſe is as an ingre-

BETONY.

dient in herb ſnuffs, in compoſitions for ſmoaking, and as a ſubſtitute to Tea. It is obſervable, that the roots of Betony differ greatly from the other parts of the plant; they operate both upwards and downwards, and ſeem to approach to the nature of the roots of Hellebore.

XII. DITTANY of CRETE.

DITTANY OF CRETE (*Origanum Creticum latifolium tomentoſum ſeu dictamnus Creticus Tourn.*) is a plant with ſmall woolly leaves, and monopetalous, labiated, purple flowers ſet in ſcaly ſpikes on the tops of the ſtalks. It grows wild in the iſland Crete or Candy, and is raiſed in gardens in ſome parts of Europe: The greateſt quantities are brought into Germany by the way of Venice, tied up in bundles, which are often mouldy or mixed with foreign matters in the inſide.

The leaves, when in perfection, yield a ſmall quantity of eſſential Oil, about half a dram at moſt upon ſixteen ounces, of a yellow colour, and an extremely ſtrong penetrating aromatic ſmell and taſte; it coagulates in the cold into the appearance of Camphor. Rectified Spirit of Wine elevates very little of the Oil, the diſtilled ſpirit having ſcarcely any ſmell or taſte. The ſpirituous extract is moderately warm and ſomewhat bitteriſh; the watery is in larger quantity, but of little taſte.

An ounce yielded with water two drams and a ſcruple of extract, and afterwards with ſpirit two ſcruples four grains: The ſame quantity, treated firſt with ſpirit, gave a dram and a half, and afterwards with water four ſcruples. The green colour of the leaves reſides in the Reſin: It is not indeed very diſtinguiſhable in the ſpirituous extract made at firſt, the gummy matter which the ſpirit takes up along with the Reſin diluting and covering it; but an extract made by ſpirit, after the gummy parts have been ſeparated by water is plainly green.

XIII. ROSEMARY.

ROSEMARY (*Roſmarinus hortenſis anguſtiore folio C. B.*) is a fragrant plant, of common uſe in perfumes, and in medicine as a corroborant of the nervous ſyſtem: Hungary-water is a vinous ſpirit im-

ROSEMARY. pregnated by diſtillation with the flavour of the flowers.

The only active principle in this plant, is the eſſential Oil: The gummy extract, diveſted of the Oil, has no remarkable taſte any more than ſmell: The reſinous extract, as pure ſpirit elevates but a part of the Oil, retains a part, and not an inconſiderable one, of the flavour of the herb. In the form of an infuſion or tincture, its fragrance may be communicated both to water and to ſpirit.

The flowers of Roſemary are ſuppoſed to be more odoriferous, or at leaſt of a pleaſanter odour than the leaves; but ſtrictly ſpeaking, the flowers are inodorous. The coloured petala, carefully picked from the cups, have neither ſmell nor taſte: Such as diſcover any degree of theſe qualities have received them from the oily matter of the cups in gathering; the veſicles in which the oily matter is lodged, being very eaſily burſt.

An ounce of the flowers, with the cups, yielded to rectified ſpirit ſeven ſcruples of extract, and afterwards to water two drams and a half: Water applied firſt took up from the ſame quantity four drams, and ſpirit afterwards one dram. Both the ſecond extracts had neither taſte nor ſmell: The firſt watery extract had very little of either; the firſt ſpirituous a notable ſhare of both together with the green colour of the flower cups. It is obſervable, that the ſecond ſpirituous extract appeared powdery, and not of a truly reſinous tenacity. The diſtilled water ſmelt and taſted conſiderably of the Roſemary, but from the quantity made uſe of in this experiment no actual Oil could be collected.

The leaves are richer in Oil: From forty-eight ounces I obtained three drams and half a ſcruple; a proportion ſmall indeed, but greater than the flowers have been known to yield. An ounce of the leaves afforded with ſpirit three drams of extract, and afterwards with water one dram five grains; On inverting the order of applying the menſtrua, the watery extract weighed three drams and the ſpirituous one dram ten grains. The green colour of the leaves, as that of the flower cups, was retained in the ſpirituous extract.

Tour-

ROSEMARY.

Tournefort obſerves, that thoſe ſorts of Roſemary, which produce neither flowers nor ſeeds, and which have very hard ſhrubby ſtalks and long narraw leaves, ſmell ſtrongly like Camphor, and yield on diſtilling a large quantity for Oil, a portion of actual Camphor.

XIV. ORANGE FLOWERS.

THE flowers of the ORANGE-TREE yield an highly odoriferous eſſential Oil, but in very ſmall quantity. This Oil is very ſubtile and volatile: It ariſes in diſtillation with rectified Spirit of Wine by the heat of a water-bath, and exhales in the air upon barely drying the flowers, leaving them nearly inſipid as well as inodorous. In ſeveral parts of Italy, expreſſed Oils are impregnated with the fragrance of theſe flowers for the purpoſes of a perfume. (See page 66.) The diſtilled water of Orange flowers is commonly called *Aqua naphæ.*

XV. SAFFRON.

THE SAFFRON plant (*Crocus ſativus C. B.*) produces a purpliſh blue flower, whoſe ſtyle or piſtil is divided at top commonly into three fleſhy filaments of a deep orange red colour: In ſome plants there are ſix filaments, three pale and three deep coloured. The high coloured parts, carefully picked, dried on papers, and preſſed into cakes, are the Saffron of the ſhops; an aromatic of common uſe both for medicinal and culinary purpoſes, ſaid to be peculiarly exhilarating, antiſpaſmodic, ſerviceable in diſorders of the breaſt, &c.

There is no part of the world that produces better Saffron than England: The German writers who hold the Hungarian and Auſtrian to be the beſt, were probably unacquainted with the Engliſh, the exportation of it being prohibited. The beſt Saffron is in long broad filaments, of a deep red colour, without any yellow parts, moderately dry, yet flexible and ſoft to the touch; difficultly pulverable; of a ſtrong and an agreeable ſmell, eſpecially at a diſtance; affecting the eyes, ſo as to draw tears from them, and of a pungent and ſomewhat bitteriſh taſte: It readily impregnates the hand with its ſmell, and ſtains the moiſt hand with a deep yellow colour. The Spaniards are ſaid to communicate the unctuoſity expected in it by actual

tual

SAFFRON.

tual Oil; and ſome, to increaſe its weight by the admixture of Carthamus flowers, and even of Litharge.

It is obſervable, that water and ſpirit almoſt equally extract the virtue and colour of Saffron; and that water improves the ſmell and heightens the colour, whilſt ſpirit ſeems rather to weaken both. I dried two ounces and a half of the beſt Saffron, in the heat of a water-bath, and collected therefrom half an ounce of liquor of an exceeding ſtrong ſmell, but which had no appearance of any ſubſtantial Oil: It is this vapour of the Saffron which affects the head, and diſorders the ſenſes. The dried Saffron, which weighed juſt two ounces, was divided into two equal parts. I diſtilled rectified ſpirit from one ounce, and pure water from the other: The ſpirit had no perceptible ſmell or taſte of the Saffron: The diſtilled water ſmelt ſtrongly of it, though not ſo ſtrongly as that which exhaled in the drying. Nevertheleſs, upon inſpiſſating the liquors remaining after the two diſtillations to the conſiſtence of extracts, the watery extract was not only in larger quantity and of a deeper colour, but of a ſtronger ſmell than the ſpirituous; a plain proof of the power of ſpirit in covering or concealing the ſmell and colour, and of water in heightening or calling them forth. That the ſpirituous extract poſſeſſed theſe qualities in a greater degree than the watery, though it did not exert them, is evident from the circumſtances of the experiment, the Saffron in both caſes having loſt them: The following experiment is a further proof of this, and of the different powers of the two menſtrua. The ſpirituous extract, ſo pale and ſo inodorous, on being diſſolved in water (for either menſtruum diſſolves nearly all that the other has extracted) gives a deeper colour, and acquires a much ſtronger and more agreeable ſmell than the watery; and on the other hand the watery extract, diſſolved in rectified ſpirit, communicates but a pale tincture, and is hardly any longer to be ſmelt at all.

With regard to the quantity of extracts, an ounce of dried Saffron yielded with water ſix drams, and afterwards with ſpirit only one ſcruple, five ſcruples re-

SAFFRON.

maining undiſſolved. An ounce treated at firſt with ſpirit gave five drams and one ſcruple, and afterwards with water one dram half a ſcruple, the reſiduum weighing a dram and a half. The firſt ſpirituous extract, pulverized and digeſted in a ſuitable quantity of water, diſſolved entirely: The firſt watery extract, digeſted in ſpirit, left twenty-four grains of a colourleſs matter like ſand.

XVI. CARDAMOM.

THE LESSER CARDAMOM is the fruit of an Eaſt-Indian plant, called in the Hortus Malabaricus *Elettari*. It is a triangular membranous capſule, of a yellowiſh-white colour on the outſide, and white within, containing about twelve or fourteen irregularly angular ſeeds lodged in three cells: Each ſeed is covered with a purpliſh or reddiſh-brown ſkin which eaſily comes off; the internal ſubſtance is white; When the ſeeds are of a greeniſh colour on the outſide, and rattle upon ſhaking the capſule, the fruit has been gathered unripe.

Theſe ſeeds are an agreeable pungent aromatic: An ounce yields about a ſcruple of eſſential Oil, containing the whole of their pungency and ſmell, with fourteen or fifteen grains of reſinous, and forty-five grains of mucilaginous extract. The huſks are ſimilar in flavour to the ſeeds, but much weaker; no actual Oil can be collected from them, though the diſtilled water ſmells ſtrongly of the Cardamoms: They contain however more ſoluble matter than the ſeeds; an ounce yields above a dram of watery, and about twenty five grains of ſpirituous extract.

There is a large and a middling ſort of Cardamoms, differing a little in appearance, and more conſiderably in their quality. The capſules of the large are of a triangular figure, and ſtand on ſeparate pedicles, like thoſe of the foregoing, but are commonly much darker in colour: The middling growing in cluſters, are paler coloured than the one, and darker than the other, in figure round, with three ſeams or furrows at the junctures of the membrane which parts them internally. Both theſe are much weaker than the ſmall ſort: They nearly agree with it in regard to the quantity of watery and ſpirituous extracts, but ſcarcely afford any ſeparable Oil, particularly the large kind.

XVII. CINNA-MON. CINNAMON is the bark of a tree of the Bay kind, growing in the iſland Ceylon, called by Hermann *Laurus zeylanicus baccis calliculatis.* Though the bark is one of the moſt grateful ſpices, the wood is inſipid and inodorous, and uſed only as firewood: The root is impregnated with aromatic matter, and yields in diſtillation not only an eſſential Oil, but a portion of Camphor. The bark is taken off twice a year, in the ſpring, before the tree begins to bloſſom, and in autumn, after the fruit has fallen: It is taken only from young trees, that of the old being woody and bitteriſh.

It has been obſerved that the thin membrane, which inveſts the internal ſurface of the bark, is vaſtly ſtronger in ſmell and taſte than the bark itſelf: Some ſuppoſe that the aromatic matter is originally confined wholly to this membrane, and thence communicated to the exterior parts in drying. Lemery is of opinion, that Cinnamon receives all its ſmell and taſte from the action of the ſun in its exſiccation: This can be no otherwiſe true, than as the active parts are more concentrated by the diſſipation of the watery: Hermann aſſures us, that it is not in the ſun but in the ſhade that the bark is dried.

Cinnamon has a very agreeable, pungent, ſomewhat aſtringent taſte, and a delightful ſmell: Greateſt part, if not all of it, is robbed of much of its better parts before it is brought to us. Its eſſential Oil is extremely pungent and fiery, but in ſmall quantity, fixteen ounces of the very beſt Cinnamon ſcarcely yielding two ſcruples and a half. The diſtilled water appears milky, and retains in it greateſt part of the Oil, which on long ſtanding it depoſites to the bottom, and then becomes clear: Oftentimes, though ſeveral pounds of Cinnamon be committed to diſtillation, we ſhall ſcarcely be able to ſeparate any Oil till the water has been kept for ſome months. Mr. Stoll of Leipſick, pretends to have a method of collecting all the Oil from the water, in a very little time; how juſtly I cannot determine: If this ſhould be found practicable, it would be a very uſeful diſcovery, provided the

CINNAMON.

Oil received no injury. The Dutch, who are maſters of the Spice Iſlands, are the only perſons who prepare the Oil of Cinnamon in quantity; but it never comes from their hands unadulterated: We ſeldom meet with Oil of Cinnamon that holds leſs than half its weight either of expreſſed Oil or of Spirit of Wine.

The Oil of this ſpice does not ariſe in diſtillation with rectified ſpirit: On diſtilling pure ſpirit from Cinnamon, it received no ſenſible impregnation; on drawing it over repeatedly from freſh parcels of the Spice, it ſmelt and taſted a little, but very weakly. An extract made by ſpirit contains the whole of the taſte and flavour of the Cinnamon: The watery extract has nothing valuable. Sixteen ounces yield two or more of ſpirituous extract, and about one and a half of watery.

XVIII. CASIA LIGNEA.

CASIA LIGNEA agrees with Cinnamon in its ſmell, taſte, and chemical compoſition, and is the bark of a tree of the ſame kind. It differs however remarkably in the proportion of its principles, containing much leſs Oil, and a vaſtly larger quantity of mucilaginous matter.

XIX. NUTMEG.

THE NUTMEG tree, which grows moſt plentifully in the iſland Banda, is ranked by ſome among the nuciferous, and by others among the pruniferous trees; the fruit being a nut, with a conſiderable quantity of ſoft fleſhy matter on the outſide. Betwixt this pulpy ſubſtance and the ſhell, lies a purpliſh red membrane, and within the ſhell is incloſed a kernel of a ſomewhat oval figure: The firſt is our Mace, the other Nutmeg. It is ſaid that the pulp has nothing of the flavour of the Mace or Nutmeg, and is unfit for eating; that the leaves of the tree ſmell ſtrongly of Nutmegs, but that the flowers have little ſmell. The candied Nutmegs brought from abroad are a preparation of the entire fruit, gathered unripe.

Nutmegs are cured in the Indies by throwing a quantity of Quick-lime upon them in large tubs, filling up the veſſels with water, and after maceration for ſome hours, rinſing and drying the Nutmegs, which are then packed up for exportation in caſks fumigated

NUTMEG. migated with Sulphur: The fine powder which we ſee in the cracks and wrinkles of the Nutmeg is the remains of the Lime. This method of preparation, though apparently prejudicial, is ſaid to be found neceſſary, for deſtroying inſects or preventing their production: This laſt effect however, it does not conſtantly produce, for it is no uncommon thing to find wormeaten Nutmegs. The Nutmegs of only one kind of tree are uſually brought into Europe, though differing not only in ſize but in figure: Some of the nuts contain two kernels, which in this caſe are flatted on one ſide, and called Royal Nutmegs.

Some prefer thoſe which diſcover internally the greateſt quantity of white variegations, but thoſe which have the leaſt are really the beſt: It is in the reddiſh-brown matter, and not in the white, that the Oil and aromatic virtue reſides, the white having ſcarcely any taſte or ſmell. It is only this inactive white part that worms prey upon; and hence a Nutmeg is not much the worſe for being wormeaten. It is amuſing to examine a wormeaten Nutmeg, that has had abundance of white veins: It looks like a curious little labyrinth.

This fruit contains two kinds of Oil, a groſs ſebaceous, and a volatile eſſential fluid one, in which laſt the taſte and ſmell of the Nutmegs wholly reſide. The eſſential Oil appears alſo to be of two kinds, one light and ſubtile, ſo as to ſwim upon water, and ariſe in diſtillation along with rectified Spirit of Wine; the other groſſer and more ponderous, ſo as to ſink in water, ariſe difficultly in diſtillation with water itſelf, and not at all with ſpirit.

From ſixteen ounces of Nutmegs I obtained half an ounce of eſſential Oil, and from four and a half to five ounces of inſipid ſebaceous Oil: This laſt remains behind after the diſtillation of the other, and in part ſwims like tallow upon the ſurface of the water: The decoction inſpiſſated, leaves a mere mucilaginous maſs, of no remarkable taſte or ſmell. Rectified Spirit of Wine diſſolves all the eſſential Oil and a part of the expreſſible; and on being again abſtracted or evaporated, leaves in the extract almoſt all that it had taken up from the ſpice.

NUTMEG.

Four ounces of Nutmegs yielded with ſpirit one ounce of oily extract, and afterwards with water half an ounce and two ſcruples of a gummy one, together with five drams and one ſcruple of expreſſible Oil as inſipid and inodorous as the Gum. The ſame quantity treated firſt with water, gave ten drams of gummy extract, with two ſcruples and a half of groſs Oil which aroſe to the ſurface during the abſtraction of the liquor, and half a ſcruple of eſſential Oil which ſunk to the bottom of the diſtilled water: The remainder, treated with ſpirit, gave five drams more of groſs Oil, and two drams of an unctuous oily extract. The earthy matter amounted in both caſes to two ounces, or half the original weight of the Nutmegs. On committing four ounces of Nutmegs, pounded and warmed, to a warm preſs, I obtained nine drams of Oil: From the reſiduum were gained an ounce of gummy extract, a pretty ſtrong taſted water, four ſcruples of oily extract with ſpirit, and a dram of inſipid Oil: The earthy matter weihed here but eleven drams.

The groſs Oil of Nutmegs brings forth with it, in expreſſion, a conſiderable portion of the eſſential Oil, and hence is impregnated with the flavour of the Spice. This Oil, or rather ſebaceous matter (for it is quite conſiſtent) is prepared in quantity in the Eaſt-Indies, and brought over ſometimes in cakes, but chiefly in ſquare maſſes like Sope, of a reddiſh-yellow colour, reſembling that of Mace: It is vulgarly called Oil of Mace. Sixteen ounces of this concrete contain five drams and a half of the eſſential Oil of the Nutmeg, which totally ſinks in water, and of which no part ariſes in diſtillation with Spirit of Wine; the more ſubtile Oil having probably been diſſipated in heating or roaſting the Nutmegs previouſly to the expreſſion. The fluid expreſſible Oil in the above quantity amounts to ſix ounces two drams and a half; and the ſolid ſabaceous ſubſtance, which gives conſiſtence to the two foregoing, to nine ounces and a half. This laſt when ſeparated from the others, is perfectly inſipid and inodorous, and of a chalky whiteneſs; hence it is an excellent baſis for odoriferous balſams: We may impregnate it with any flavour by the addition of ſuitable

XX. MACE. ble eſſential Oils, and tinge it of any colour by coloured powders: It melts in a gentle heat like Tallow.

MACE, one of the exterior coverings of the Nutmeg, is at firſt of a purpliſh-red colour, which changes, before it arrives among us to an orange yellow, and by long keeping grows paler and paler: Mace is a warm aromatic, like the Nutmeg, accompanied with a degree of bitteriſhneſs; and like that Spice alſo contains both an eſſential and expreſſible Oil.

Sixteen ounces of Mace yielded with rectified ſpirit four ounces and a half of extract, which retained ſome of the expreſſible and the more ponderous part of the eſſential Oil, the lighter ariſing towards the end of the inſpiſſation, and impregnating the diſtilled ſpirit: From the reſiduum were obtained two ounces and a half of gummy extract, eight ounces and ſix drams remaining undiſſolved. The ſame quantity, treated with water firſt, gave four ounces of gummy extract, with five drams of eſſential Oil, which aroſe during the inſpiſſation, and ſunk to the bottom of the diſtilled water: The reſiduum gave with rectified ſpirit three ounces of an oily extract, eight ounces and a half remaining undiſſolved. The watery extract has an unpleaſant ſomewhat ſaline taſte, which that of Nutmegs has nothing of. On expreſſion, Mace yields an Oil leſs conſiſtent than that of Nutmegs, and which is uſually brought from the Eaſt-Indies in glaſs or porcelane veſſels.

CLASS VI.

Vegetables whoſe qualities depend partly upon an eſſential Oil, and partly on a gummy-reſinous matter.

OILY GUM RESINOUS. THE ſubſtances of this claſs agree with thoſe of the foregoing in containing an eſſential Oil, ſometimes in large and ſometimes in ſmall quantity. They differ in containing other active matters joined to the Oil. There, the Oil and diſtilled water poſſeſs the whole of the ſpecific taſte and ſmell of the ſubject: Here they poſſeſs but a part, the decoction left after the

Oily Gum Resinous.

the diſtillation, retaining a conſiderable ſhare of that peculiar taſte by which the original vegetable was diſtinguiſhed. Thus the Carline-thiſtle, Camomile, Wormwood, Orange-peel, *&c.* leave all their bitterneſs in the decoction, whilſt all their ſmell and flavour diſtil: And ſome of the ſpices, as Cloves and Pepper leave in like manner greateſt part of their pungency behind.

I. Carline.

The Carline-thistle (*Carlina acaulos magno flore albo, C. B.*) is a very prickly ſort of Thiſtle, without any ſtalk, growing in mountainous countries, particularly in the mountains of Switzerland. The roots are brought to us tied in bundles, chiefly from Thuringia. They are ſix or eight inches in length, about the thickneſs of the little finger, of a brown colour on the outſide and whitiſh within; of a ſtrong not agreeable ſmell, and a bitter pungent taſte. They are ſometimes uſed as diaphoretics and alexipharmacs, but chiefly in the diſorders of cattle.

Sixteen ounces of this root yield about two ſcruples and a half of eſſential Oil: This contains the ſmell and all the ſpecific taſte of the root, as the Reſin does its bitterneſs. It is difficult to obtain the Oil and the Reſin perfectly pure from one another. A tincture made in rectified ſpirit, leaves, on being inſpiſſated to an extract, almoſt all the Oil, along with the Reſin, and a portion of the gummy matter, the diſtilled ſpirit having ſcarcely any ſmell or taſte. And on the other hand, in diſtilling the Oil with water, ſome of the more ſubtile parts of the Reſin conſtantly ariſe with it, rendering the Oil thick and ropy, or diſpoſed to become ſo upon ſtanding for a little time, and ſo ponderous as to ſink in water: On rectifying the Oil, or diſtilling it a ſecond time with a gentle heat, it ariſes fluid and thin, and floats on the ſurface of the water, leaving behind a conſiderable quantity of groſs reſinous matter.

Two ounces of the root, cut in ſmall pieces, yielded with rectified Spirit two drams thirty eight grains of reſinous extract, ſufficiently ſtrong both in ſmell and taſte, and poſſeſſing nearly all the active parts of the Carline: From the reſiduum were obtained, by water, ſix

CARLINE. drams two ſcruples of mucilaginous extract, in taſte ſlightly bitteriſh and ſomewhat ſaline. On inverting the order of applying the reſpective menſtrua, the watery extract amounted to an ounce and half a dram, and the ſpirituous only to forty-five grains. The watery extract made at firſt was much ſtronger than that made after the action of ſpirit, but far weaker than that made by ſpirit at firſt.

II. NIGELLA. THE ſeeds of FENNEL-FLOWER, *Nigella, Melanthium, Gith,* (*Nigella flore minore ſimplici candido C. B.*) are of an irregularly angular figure, a black colour on the outſide and greyiſh within, of a pungent aromatic and ſomewhat oily ſmell and taſte. We often find among them ſome yellow ones, which are ſuppoſed to be unripe.

Theſe ſeeds contain only a ſmall quantity of volatile eſſential Oil, but a larger of a groſs expreſſible one, ſeparable not only by actual expreſſion, but by extraction with Spirit of Wine, the Oil diſſolving in the ſpirit along with the reſinous matter, and afterwards parting from it in the evaporation: A groſs Oil may be collected in this proceſs, whether the gummy matter has been previouſly ſeparated by water or not, with only this difference, that the Oil obtained after the action of water becomes ſooner rancid than the other.

Two ounces of the ſeeds yielded with rectified ſpirit three drams of extract, and afterwards with water three ſcruples and a half: Water applied at firſt extracted juſt as much as ſpirit did; but ſpirit after water took up leſs by a ſcruple and a half than water after ſpirit. The quantity of Oil which ſeparated in the ſpirituous extraction, was four ſcruples. The diſtilled ſpirit ſmelt and taſted conſiderably of the ſeeds: The ſpirituous extract was nevertheleſs ſtronger than the watery——These ſeeds are recommended in catarrhs, vertigos, quartans, *&c.* and as an errhine.

III. BIRTHWORT. BIRTHWORT, *Ariſtolochia,* ſo called from the medical virtues aſcribed to it, is a plant with an irregular, tubulous, monopetalous flower. Three ſorts are mentioned by pharmaceutic writers: *Ariſtolochia rotunda flore ex purpura nigro C. B.* round-rooted

Birth-

BIRTH-WORT.

Birthwort. *Ariſtolochia longa vera C. B.* long-rooted Birthwort; and *Ariſtolochia clematitis recta C. B.* ſlender or creeping-rooted Birthwort. The name Birthwort is appled alſo to two plants of another genus, the bulbous rooted Fumitories: The *Ariſtolochia rotunda vulgaris* or *cava*, is that called by Caſpar Bauhine *Fumaria bulboſa radice cavâ, major, flore rubro dilutiore:* The *Ariſtolochia fabacea* is the *Fumaria bulboſa radice non cava minor* of the ſame author. Of all the ſorts, the root is the part principally made uſe of: Thoſe of the *round* are pretty thick, unequal, full of round protuberances, ſometimes ſhaped like a kidney, externally brown, internally yellow like Boxwood: Thoſe of the *long* are alſo brown on the outſide and yellow within, near a foot in length, from two to three or four fingers in thickneſs, and full of wrinkles: Thoſe of the *creeping-rooted* are the longeſt and ſlendereſt, and of the darkeſt brown colour on the outſide; the largeſt are ſcarce ſo thick as the little finger, and the greater number ſcarce half ſo thick: The roots of the *Rotunda vulgaris* are about the ſize of Walnuts, pointed in the middle, brown without, hollow within: Thoſe of the *Fabacea* are no larger than Filberts, commonly flatted, externally yellow, internally mealy and white.

In taſte they are all bitter and aſtringent, but in different degrees: The *Fabacea* is much the weakeſt, and the ſlender rooted ſort the ſtrongeſt. Hence they differ alſo in medicinal virtue: Simon Paulli obſerves particularly of the long-rooted, that a decoction of it in the diſtilled water of Veronica is of excellent ſervice againſt ulcerations on the ſhin bone, and ſays he has received the thanks of many ſurgeons for the communication of this medicine.

With regard to their chemical analyſis, they all give out more to water than to ſpirit: An ounce yields with ſpirit ſomewhat more than a dram of reſinous extract, whilſt the ſame quantity, treated with water, gives upwards of two drams of a gummy one. The ſpirituous extract taſtes ſtrongly of the root, but the watery has very little taſte. In diſtillation, rectified ſpirit brings over nothing from the root; the diſ-

BIRTH-WORT. tilled water has a diſagreeable kind of ſmell, different from that of the Birthwort itſelf.

The leaves of one of the Birthworts, namely of the long ſort, are ſometimes alſo employed medicinally. Theſe are of the ſhape of a heart, full of veins both longitudinal and tranſverſe, and of an extremely ſtrong ſmell. They give out conſiderably more than the roots do to rectified ſpirit, and ſomewhat more to water: From an ounce were obtained two drams of ſpirituous, and from another ounce two and a half of watery extract.

It has been affirmed, that the fixed alcaline ſalt obtained from Birthwort by burning, is of a peculiar kind; that it does not, like other fixed alcalies, throw down a yellow Precipitate from ſolution of Mercury-ſublimate. Tournefort mentions this particularity of the *Clematitis* or ſlender rooted ſort, and ſays he took it from the experiments upon the regiſters of the French Academy. I have tried the experiment, and found that the ſmalleſt portion of the Salt of Birthwort, added to a ſolution of Sublimate, throws down a yellow Precipitate equally with the alcaline Salts of other plants.

WORM-WOOD. THE leaves of common WORMWOOD (*Abſinthium vulgare majus J. B.*) are intenſely bitter, and have a ſtrong ſmell, ſomewhat of the aromatic kind, but ungrateful. They yield in diſtillation a conſiderable quantity of eſſential Oil, of a dark greeniſh colour, poſſeſſing the whole of their ſmell, the bitter matter remaining in the extract.

V. CAMO-MILE. Common. THE flowers of the common CAMOMILE (*Chamæmelum vulgare, leucanthemum dioſcoridis C. B.*) contain alſo a bitter ſubſtance joined with an eſſential Oil of a peculiar ſtrong flavour.

The quantity of Oil is very ſmall, a whole pound of the flowers yielding ſcarcely above a ſcruple: It reſides, not in the white petala, nor in the yellow diſk, but ſolely in the cup of the flower. This Oil appears of a beautiful deep blue colour; not as ſome have ſuppoſed from its diſſolving a part of the Copper veſſel, in which theſe kinds of diſtillations are uſually performed

CAMOMILE.

formed, for it proves of the ſame colour when drawn in glaſs ones: By age, its fine colour gradually decays, and changes at laſt to a browniſh or a greeniſh yellow. Hoffmann reports that the genuine Oil of Camomile will not continue blue above a year, and that ſuch as holds its tincture longer than that time has received it from art: But on trial, the genuine as well as the counterfeit Oil, if kept in bottles quite full and cloſely ſecured from the air, are found to retain their colour for two or three years or more, and both of them to loſe it in a ſhort time if there is any vacuity in the veſſel, or if the air is admitted: The blue colour of the counterfeit is deſtroyed by air, and changed to a green, even ſooner than that of the genuine.

An ounce of the dry flowers yielded with Spirit of Wine three drams, and afterwards with Water two drams of extract: Water applied at firſt extracted, from the ſame quantity four drams, and Spirit afterwards one dram: The indiſſoluble reſiduum weighed in both caſes three drams.

Simon Paulli obſerves that theſe flowers contain a manifeſt ſaline ſubſtance; that when digeſted and boiled in Wine, and two or three freſh parcels boiled in the ſame liquor, the Wine preſſed out from them taſtes at length notably ſaline. I repeated this experiment, and found the liquor to be of a truly ſaline taſte, approaching in ſome degree to that of common Salt. I therefore tried it with a ſolution of Silver and of Quickſilver: It occaſioned a precipitation in both, but the precipitate of the Silver was not a *Luna Cornea*, nor that of the Mercury ſimilar to Corroſive Sublimate, which they would have been if the Salt had been of the marine kind. It is probable, that the Salt proceeded in good meaſure from the Wine, though the taſte of the decoction was different from that of boiled Wine by itſelf.

Camomile flowers are ſuppoſed to have an antiſpaſmodic and mild anodyne virtue, depending on their Oil: Their bitter matter is ſimilar in quality to that of Wormwood, Gentian, Centaury, &c. The oil, as

V. CAMOMILE already obſerved, is lodged in the cup; the bitterneſs prevails chiefly in the yellow diſk of the flower.

Roman. The flowers of the Roman Camomile *Chamæmelum nobile ſive leucanthemum odoratius C. B.* have a ſtronger and more agreeable ſmell than thoſe of the common. They yield a larger quantity of eſſential Oil; but the Oil has nothing of the fine blue colour of the other. The quantity of gummy and reſinous matter is almoſt exactly the ſame in both.

VI. ORANGE and LEM. PEEL. THE outer yellow rind of the PEELS of ORANGES and LEMONS contains a bitteriſh matter accompanied, with a very fragrant aromatic Oil, ſo volatile as to ariſe in diſtillation with rectified Spirit as well as with Water. The Oil drawn with Spirit is the moſt elegant of the two, and that from the freſh Peels more ſo than from the dry: But none of the Oils prepared by diſtillation are equal to that extracted by puncture or ſcarification.

All eſſential Oils are imbibed readily by pure dry Sugar, and unite with it into a compound ſoluble in Water: In this form, called *Elæoſaccharum*, they are often made uſe of in medicine: An elæoſaccharum of Orange and Lemon-peel may be obtained, by rubbing the fruit upon a lump of Sugar till all the yellow part is abraded, and then ſcraping off ſo much of the Sugar as appears impregnated with the Oil.

V MILFOIL. THE flowers and tops of the common purpliſh-flowered MILFOIL or yarrow (*Millefolium vulgare purpureum minus C. B.*) afford a beautiful blue Oil ſimilar to that of Camomile. The white flowered ſort yields an Oil of the ſame flavour with the other, but which has nothing of its colour.

Theſe flowers have a not diſagreeable aromatic ſmell, and a roughiſh, bitteriſh, ſomewhat pungent taſte: The bitterneſs and aſtringency remain in the extracts, whether made by Spirit or by Water. An ounce of Milfoil tops yielded with Water three drams and a ſcruple, and afterwards with Spirit only ſix grains: Spirit applied at firſt extracted, from the ſame quantity, two drams and a half, and Water afterwards one dram thirty-ſeven grains: The indiſſoluble reſi-

duum

MILFOIL.

duum weighed in the firſt caſe four drams thirty-ſeven grains, in the latter forty grains leſs——This plant is looked upon as an excellent corroborant and antiſpaſmodic.

VIII. PIMPINELLA. NIGRA.

THERE is another plant which affords a blue Oil that ariſes not only with Water, but with highly rectified Spirit of Wine; the *Pimpinella nigra* or BLACK BURNET SAXIFRAGE. This plant has not hitherto been deſcribed by the botaniſts: It appears to be a ſpecies of *Tragoſelinum*, and may not improperly be called *Tragoſelinum majus radice nigra*: Perhaps it is the *Tragoſelinum alterum majus* of Tournefort, *Pimpinella Saxifraga major altera* of Caſpar Bauhine, *Saxifragia hircina minor foliis ſanguiſorbæ* of John Bauhine, *Tragoſelinum minus, Pimpinella minor* of Tabernæmontanus. Its leaves are ſomewhat different from thoſe of the *Pimpinella alba* (page 93.) but the principal difference is in the roots, which inſtead of being of a white colour throughout, are black on the outſide, and variegated internally with bluiſh veins. As the French chemiſts called in queſtion the blue Oil of this root, I ſent them a ſpecimen of the Oil drawn by myſelf, of its blue diſtilled ſpirit, and of the entire plant with its root, flowers and ſeeds; with a quantity of roots for repeating the experiments, and a quantity of freſh ſeeds for propagating the plant. The Spirit ariſes blue only about the middle of the diſtillation, the firſt and the laſt runnings being colourleſs: If theſe are kept apart, the Spirit proves of a deep blue colour; if the whole is mixed together, very pale. The diſtilled Water has no blueneſs. The Oil, like thoſe of Camomile and Milfoil, ſoon loſes its blue colour in the air, changes to a green, and at laſt to a yellow.

This black Pimpinella root has the ſame ſmell and taſte with the white ſort formerly examined: It yields alſo the ſame principles on extraction with Water and with Spirit, but in ſomewhat different proportions. From two ounces were obtained by rectified Spirit three drams of a reſinous extract, more unctuous or oily than that of the white Pimpinella, and afterwards

PIMPINELLA NIGRA.

by Water three drams of a gummy extract: Water applied at firſt extracted five drams, and Spirit afterwards only one: The reſiduum in both caſes, weighed ten drams.

IX.
CALAMUS AROMAT.

CALAMUS AROMATICUS, or *Acorus Verus*, is the root of a kind of flag, growing in marſhy places in ſome parts of Europe: It is pretty long, full of joints, of a whitiſh-reddiſh, and partly of a greeniſh colour on the outſide, white and ſpongy within, eaſy to break, of a ſtrong aromatic ſmell, and a warm pungent taſte. In firm grounds, it ſpreads into many ſlender ſtrings, which in mere watry ones it does not.

The diſtinguiſhing taſte and grateful flavour of this root reſide wholly in the eſſential oil, the decoction remaining after the diſtillation of the oil, having a nauſeous taſte not at all like that of the Calamus: From ſixteen ounces of the dry root little more than two ſcruples of Oil are obtained: from the freſh roots we can ſcarcely collect any, the Oil remaining all diſſolved in the diſtilled water. Hermann reports that the Oil and Water of Calamus Aromaticus are highly ungrateful, but they are quite the reverſe: Nor do the old decayed roots, which Wedel ſuſpects Hermann's Oil and Water to have been drawn from, give any thing diſagreeable in diſtillation.

Highly rectified Spirit elevates little or nothing of this Oil: Hence a ſpirituous extract made from the root ſmells conſiderably, and taſtes ſtrongly of the Calamus. Two ounces yielded with Spirit ſix drams and half a ſcruple, and afterwards with Water three drams ten grains of extract: Water applied at firſt extracted, from the ſame quantity, ſeven drams thirty five grains; and Spirit afterwards forty-three grains

X.
CYPERUS.

CYPERUS (*Cyperus rotundus Orientalis major C. B.*) is the root of a plant approaching to the flag kind, brought from the eaſtern countries: It is nearly of the ſhape of an Olive, of a reddiſh brown colour on the outſide, of a reddiſh white within, compact, pretty ponderous, of an agreeable aromatic ſmell and

taſte,

CYPERUS.

taſte, with a ſlight bitterneſs and aſtringency. The French, inſtead of this commonly uſe a root of their own growth (*Cyperus rotundus vulgaris C. B.*) which does not greatly differ from the Oriental: This ſort is found alſo in Switzerland, Italy, and ſome other parts of Europe.

The ancients employed Cyperus as a Spice: At preſent it is ſometimes uſed medicinally, but chiefly as an ingredient in hair-powders, ſweet-ſcented powders for clothes, and other like purpoſes. The quantity of Oil it contains is very ſmall: From an ounce or two of the root we can ſcarcely collect any. Rectified Spirit of Wine, elevates nothing of this Oil, but diſtills flavourleſs as it was employed: Hence the ſpirituous extract retains the flavour as well as the taſte of the root, though the watery extract is rather ſtronger in taſte.

Two ounces of the root yielded with Spirit three drams of extract, and afterwards with Water three drams and a ſcruple: The ſame quantity, treated firſt with Water, gave ſix drams, and afterwards with Spirit half a dram: The indiſſoluble earthy matter weighed in the firſt caſe nine drams two ſcruples, and in the latter nine drams and a half.

XI. ZEDOARY.

ZEDOARY is the root of a plant ſaid to be of the Ginger kind, growing in different parts of the Eaſt Indies, and brought to us chiefly from Bengal. There are two ſorts of it, a long and a round: The firſt, which is accounted the beſt, is about the ſize of the little finger, ſometimes larger and ſometimes ſmaller, of a whitiſh and yellowiſh grey colour, darker on the outſide and lighter within, compact and firm, of an aromatic ſmell and taſte ſomewhat approaching to thoſe of Roſemary and Camphor, accompanied with a degree of bitterneſs.

Sixteeen ounces of this root yield about a dram, ſeldom more, of eſſential Oil, poſſeſſing the whole of its ſmell and aromatic flavour; the bitterneſs remaining in the decoction. The oil is very ponderous, ſinks in Water, and difficultly ariſes in diſtillation: The more ſubtile part which comes over firſt is almoſt co-

ZEDOARY. colourleſs; the reſt is parly greeniſh, and partly blackiſh. Rectified Spirit elevates a little of its finer parts, but does not receive near ſo ſtrong an impregnation as Water does; and hence the ſpirituous extract retains much of the peculiar flavour of the Zedoary, which in the watery is wholly loſt.

Sixteen ounces, yielded of watery extract five ounces five drams, and one ſcruple: after which, Spirit extracted about two drams two ſcruples of an almoſt inſipid Reſin. The ſame quantity, treated firſt with Spirit, gave an ounce and a half, and afterwards with Water full five ounces: This laſt extract taſted much bitterer than that obtained by applying Water at firſt.

XII. GINGER. GINGER is the produce both of the Eaſt and the Weſt Indies. Two ſorts of this root are brought to us, one internally white, the other brown: Whether they are the roots of different ſpecies of the Ginger-plant, or of one ſpecies taken up at different ages or in different ſeaſons, is not certainly known. This pungent aromatic is of common uſe as a ſpice, and is obſerved not to heat the conſtitution near ſo much as might be expected from its ſtrong biting taſte. Its pungency reſides not in its volatile but in its fixed parts: The eſſential Oil contains the ſmell and diſtinguiſhing flavour of the Ginger, but all the pungency is left behind in the ſtill.

brown, From ſixteen ounces of the common brown Ginger may be obtained a dram or a little more of Oil. The ſame quantity yielded, with rectified Spirit, an ounce and two ſcruples of reſinous extract, containing all the hot biting matter of the root: From the reſiduum, Water extracted a ſtrong mucilage, which had little or no taſte, was difficultly reduced to dryneſs, and weighed, when exſiccated, five drams and a half. Sixteen ounces, treated firſt with Water, gave four ounces of extract, conſiderably pungent, a portion of the reſinous matter being taken up by the Water along with the gummy: From the reſiduum, Spirit extracted five ſcruples four grains of a very pungent

Reſin

GINGER.

Reſin. The indiſſoluble earthy matter amounts to near three fourths of the root, *viz.* eleven ounces ſix drams and ſixteen grains. Rectified Spirit elevates in diſtillation ſome of the more ſubtile parts of the Oil, ſo as to taſte a little of the Ginger, though not conſiderably.

white

The white Ginger contains more ſoluble matter than the brown. From ſixteen ounces of this ſort were gained five ounces five drams and a ſcruple of watery, and afterwards three drams twelve grains of ſpirituous extract. Spirit applied at firſt extracted one ounce and three drams wanting a few grains: and Water, applied afterwards took up four ounces and a half; ſo that the indiſſoluble part does not amount quite to ten ounces on ſixteen. The quantity of eſſential Oil, is nearly the ſame as in the brown ſort.

XIII. GALANGAL. larger

The greater GALANGAL, an Eaſt Indian knotty root with ſeveral circles on the ſurface, of a reddiſh brown colour on the outſide and a yellowiſh white within, greatly reſembles Ginger in its ſmell, taſte, and chemical compoſition; but as Ginger is the moſt grateful of the two, the Galangal is ſcarcely ever uſed.

ſmaller

The ſmaller Galangal, which is knotty and marked with circular ſtriæ like the other, commonly about the ſize of the little finger, and of a brown colour both externally and internally, is in ſmell ſtronger and more agreeable than the large, and in taſte more pungent and hot like Pepper. It contains but a ſmall proportion of Oil: Sixteen ounces afforded ſcarcely two ſcruples; though probably if conſiderable quantities were diſtilled at once, and the diſtilled Water of one operation employed inſtead of freſh Water in the next, the yield upon the pound would be greater. The Oil is leſs agreeable in ſmell than the Galangal itſelf, and wants its pungency, which of conſequence remains in the extract. Very little of this Oil ariſes with rectified Spirit: The Spirit diſtilled even from a large quantity of the root, has ſcarcely any taſte or ſmell. With regard to the extracts, the watery is rather more pungent than the ſpirituous; but the former have

no-

GALANGAL. nothing of the peculiar flavour of the Galangal, greateſt part of which is retained in the latter. Sixteen ounces yielded with Water ſix ounces and afterwards with Spirit four drams two ſcruples: Spirit applied at firſt extracted an ounce and a half from ſixteen, and Water extracted afterwards five ounces.

XIV. CLOVES. THE CLOVE tree, *Caryophyllus aromaticus fructu oblongo C. B.* is a native of the Molucca iſlands, and has not been found to thrive ſo well in any other part even of the Eaſt Indies. It is about the ſize of a large cherry-tree: The leaves are ſomewhat like thoſe of the bay; and the wood like box wood. The Clove-ſpice has been ſuppoſed by ſome to be the flowers, by others the fruit of the tree, but it does not appear to be either of theſe: It is ſtrictly the cup of the unexpanded flower, as Dr. Schrœck firſt obſerved in the *Ephemerides Naturæ Curioſorum.*

'The manner of fructification of the Clove tree may be underſtood from that of the common Dog-roſe. The Dog-roſe puts forth, at the ends of the branches, roundiſh buttons, which open at the extremity into ſeveral pointed ſegments, ſurrounding a little knob, which gradually unfolding becomes the flower: When this falls, the button, which ſerved for its cup, becomes the fruit. The Clove-tree, inſtead of a round, has an oblong cup like a nail, four points at the end turning outwards and forming the head: This is at firſt green; when the rudiments of the flower begin to ſhew themſelves in the middle of the points, it turns reddiſh or browniſh, and in this ſtate is the Clove-ſpice.'

Some report that the Cloves fall off of themſelves, others that they are ſhaken, and others that they are beaten off. There is little probability of their being procured by any of theſe means: Theſe cups, as thoſe of other flowers, adhere firmly to the plant: by beating, they would be bruiſed or broken, or at leaſt loſe the flower buds at the end, which eaſily come off, and which are ſtudiouſly preſerved. We cannot ſuppoſe them gathered any otherwiſe than by hand. Nor is it probable, that they are dried in

ſmoke,

ſmoke, or dipt in Sea-water before the drying; for both theſe would be injurious to them.

Cloves, as brought to us, are externally of a reddiſh brown colour, internally of a paler yellowiſh, of a ſtrong aromatic ſmell, and a very hot pungent taſte: They are eaſily broke by the fingers, which they impregnate at the ſame time with their ſmell: On piercing them with a needle, a little liquid matter like Oil oozes out; a mark of the goodneſs of the Cloves. The Dutch, who are the maſters of the Clove iſlands, diſtil large quantities of the Oil of Cloves upon the ſpot, and ſupply the other parts of the world with the eſſential Oil as well as with the Spice in ſubſtance: The Cloves that have been thus robbed of their Oil they mingle with freſh Cloves, from which they acquire a conſiderable ſhare of ſmell. A light brown colour gives ſuſpicion of this abuſe, and if we examine theſe pale ones by themſelves, we ſhall eaſily find whether they retain or have loſt their native Oil.

The Dutch Oil of Cloves is extremely hot and fiery, and of a reddiſh brown colour, and theſe are in general looked upon as characteriſtics of its genuineneſs. This Oil, however, in its pure and perfect ſtate, is very far from having either of theſe qualities. When newly diſtilled it is colourleſs; by long keeping, in glaſſes not quite full or not ſufficiently ſecured from the air, it becomes more and more yellow or brown. It ſmells exceeding ſtrongly of the Cloves; but its taſte is quite mild in compariſon to that of the Dutch Oil.

The pungency of this Spice reſides in the Reſin, or rather in a combination of the Reſin with the Oil: The ſpirituous extract is exceſſively fiery: but if this extract be freed from its Oil by diſtillation with Water, the Oil that ariſes proves mild, and the remaining Reſin inſipid. The ſhare of heat and pungency which the Oil does retain, ſeems to proceed wholly from a portion of the Reſin elevated along with it; we can free it ſo far from reſinous matter that it ſhall be equally ſoft and inſipid upon the

tongue

CLOVES. tongue with Oil of Almonds, its ſmell ſtill continuing.

The Dutch Oil of Cloves is largely adulterated: From an ounce I have ſeparated no leſs than half an ounce of an inſipid and inodorous expreſſed Oil. As this addition renders the genuine Oil ſtill milder, they muſt neceſſarily employ ſome other to give it fieryneſs; and this is probably the ſpirituous extract, which I have found to communicate at once both the pungency and the high colour.

Where genuine Oil of Cloves is wanted, for medicinal or other uſes, we muſt diſtil it ourſelves, and this we may do with eaſe. I know of no herb, root, bark, fruit or ſeed, that yields ſo much: From ſixteen ounces of Cloves, I obtained two ounces two drams: Hoffmann gained two drams more. It is convenient to uſe a low head, to return the diſtilled Water upon the remaining Cloves, and to repeat the diſtillation two or three times; this Oil being very ponderous, ſo as not readily to ariſe. It conſtantly ſinks in Water, tho' Pomet and Valentine make it a mark of its goodneſs to ſwim. Pure Spirit of Wine elevates nothing of it, whether the Spirit is drawn over from the Oil itſelf or from the Clove in ſubſtance. The decoction remaining after the diſtillation of the Oil yields, on being inſpiſſated, a nauſeous ſomewhat aſtringent extract, amounting to ſix drams and a ſcruple from two ounces of Cloves: The ſame quantity yields, of ſpirituous extract, only about five drams.

ANTOPHYLLUS. THE fruit of the Clove-tree (called ANTOPHYLLUS) is of an oval figure, with an umbilicus or crown at the extremity, from the remains of the flower. It conſiſts of a ſkin or membrane, including a kernel about the hardneſs of a Bay-berry. It is much weaker than Cloves both in ſmell and taſte, though ſome have injudiciouſly preferred it to them. The active matter of the Clove or cup reſides chiefly in its cortical part: As the Clove increaſes, this matter is partly altered or diſſipated, and partly propelled more and more outwards, till, in the fruit, all of it

Cloves.

that remains is confined ſolely to the exterior ſkin, the kernel having nothing of the Clove flavour.

XV. Pimento.

AMOMUM is an exotic fruit, commonly ranked among the ſeeds. There have been different conjectures about the Amomum of the ancients, and different ſubſtitutes propoſed in the room of that unknown Spice. The Amomum of the German ſhops is an American berry, called by the Engliſh Jamaica Pepper, Pimento, or All-ſpice; by ſome *Piper chiapæ, tavaſci, odoratum, Grana caryophylli, Baccæ pantaromaticæ.*

The Jamaica Pepper-tree is a native of the iſland whoſe name it bears, particularly of the hilly tracts on the north-ſide. It riſes to the height of about thirty feet, covered with an extremely ſmooth grey bark: It is full of branches, clothed with dark ſhining green leaves, pointed at both ends, of an aromatic ſmell when rubbed, like that of the common Bay-leaves: On the extremities of the branches come forth cluſters of flowers, each ſtanding on a ſeparate pedicle, compoſed of four pale green herbaceous petala, with ſeveral ſtamina in the middle: The berries have a crown on the top, compoſed of four little leaves; at firſt they are green; when ripe, they are black, ſmooth and ſhining, and larger than Juniper-berries: Internally they contain a moiſt, green-coloured, pungent, aromatic pulp, and two hemiſpherical ſeeds or kernels, joined together by the flat ſides, with a ſkin between them. The berries are gathered in their unripe ſtate, and dried in the ſun; by which their green colour is changed to a yellowiſh, browniſh, and at length to a reddiſh or ruſty brown, or a dark brown.

Such is the Pimento-tree as deſcribed by Sir Hans Sloane in the Philoſophical Tranſactions, No. 292, under the name of *Myrtus arborea aromatica, foliis laurinis* (aromatic Tree-myrtle, with Bay like leaves.) Plukenet and Dale make the true Pimento the produce of a different Species. The former diſtinguiſhes Sloane's tree by the name of *Caryophyllus aromaticus Americanus, lauri acuminatis foliis, fructu orbiculari,* (American

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(American Clove-tree, with acuminated leaves like thoſe of the Bay, and a round fruit; and the tree, which he propoſes himſelf, by that of *Caryophyllus aromaticus Americanus, foliis & fructibus rotundis, dipyrene, ſeminibus fere orbiculatis planis,* (American Clove tree, with round leaves and fruit, and in each berry two roundiſh flat ſeeds). In his *Almageſtum* he mentions a third ſpecies, *Caryophyllus aromaticus Americanus, folio & fructu oblongo, polypyrene, acinis anguloſis uvarum vinaceis ſimilibus,* (American Clove-tree, with oblong leaves and fruit, angular ſeeds like thoſe of grapes, and more than two in one berry). But theſe are probably rather varieties than different ſpecies, as Sir Hans, a very ſkilful botaniſt, and who lived many years on the ſpot, refers them all to the tree which he deſcribes.

Thus much is certain, that the berries of the ſeveral trees are uſed promiſcuouſly. Among thoſe brought to us, we may diſtinguiſh not only different ſizes, from their age or degree of maturity, but differences in ſhape, in the appearance of the crown or navel, and in the figure and number of the kernels. Some are round, ſome oval, ſome pear ſhaped, and others flatted: In ſome the crown is flat, in others elevated: The ſeeds are in ſome hemiſpherical, in ſome angular, in others flat, approaching to a kidney ſhape: The number of ſeeds is moſt commonly two, ſometimes three, four, or more; rarely or never one. Cluſius indeed makes but one ſeed in each berry, but he was deceived by the two joined together. I have obſerved alſo another ſort, not mentioned by Sloane, Plukenet, or any author I know of: Inſtead of the berries ſtanding all on diſtinct pedicles, there are three, four, or more, upon one; and theſe flatted in a ſingular manner, with always a piece of the main ſtalk projecting beyond them. I have ſometimes found among the berries ſmall particles of Reſin, in appearance reſembling Myrrh, but differing from it in taſte; adhering ſtrongly to the berry, from which it had probably been melted out by the ſun's heat.

The

Pimento.

The ſeveral ſorts of theſe berries, however different in appearance, agree in quality. They have a pleaſant aromatic ſmell and taſte, compoſed as it were, of thoſe of Cloves, Nutmegs, Cinnamon, Pepper and Juniper-berries. The Clove flavour prevails above the reſt. The beſt are thoſe whoſe ſmell and taſte are the ſtrongeſt. They are uſed in large quantity in England, rather as a common Spice than in medicine: They are preferred to moſt other ſpices, as being of a milder nature, and leſs apt to heat the conſtitution.

With regard to the component parts of Jamaica Pepper, we find little or nothing in books, except that Sloane has mentioned that an Oil may be diſtilled from it. Upon a chemical examination it appeared to conſiſt of (1.) An indiſſoluble earth, exceeding in quantity all the other principles taken together, and amounting to five drams and a ſcruple upon an ounce. (2) Gummy or mucilaginous matter, which is the ingredient next in quantity. An ounce, treated with water at firſt, gave two drams and two grains of gummy extract; and another ounce, freed by rectified ſpirit from all that that menſtruum could diſſolve, yielded ſtill with water five ſcruples of Mucilage. (3) A reſinous ſubſtance in ſmaller quantity. The reſinous extract obtained by applying rectified ſpirit at firſt, amounted to only one dram and ſix grains from an ounce: An ounce, freed from its mucilaginous matter by coction in water, yielded of pure Reſin no more than one ſcruple. (4) An eſſential Oil, in ſtill ſmaller quantity: Of this principle, an ounce contains ſcarce half a dram, or one ſixteenth.

Upon examining the qualities of the ſeveral products, it appeared, (1) That the Oil is the principal and the characteriſtic part, containing all the ſmell and the aromatic flavour, though not the pungency of the berry. As the prevailing flavour of Pimento approaches to that of Cloves, the Oil alſo greatly reſembles the genuine Oil of that ſpice: It has the ſame kind of ſmell and taſte, diſcovers no great heat

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or pungency, and is ſo ponderous as to ſink in water: To which may be added, that the Oil of Pimento, like that of Cloves, reſides chiefly in the ſhell or cortical part, the internal ſubſtance yielding little or none. (2) That the heat and pungency are lodged in the Reſin. In this reſpect alſo Pimento agrees with Cloves; but as Pimento in ſubſtance is far leſs hot and fiery than Cloves, its Reſin likewiſe is proportionably more mild. This Reſin differs further from that of Cloves, in having an ungrateful kind of taſte, ſomewhat like that of an extract made from green Walnut-ſhells; and appearing, when pure, of a deep green colour. This colour is obſerved particularly in the tincture and extract made after the mucilaginous parts have been ſeparated by water: A ſingle grain of this extract tinges half an ounce of ſpirit. The colour proceeds from the green pulp; and as nothing of it is diſcoverable in the watery extract made after ſpirit, we may conclude that this pulp, or at leaſt its colouring matter, is a true Reſin. (3) That the gummy parts have very little activity. An extract made by water at firſt contains a little Reſin along with the Gum, as one made by ſpirit at firſt contains ſome Gum along with the Reſin. Hence the ſlight taſte of the firſt watery extract, and the pale unequal colour of the firſt ſpirituous extract.

Rectified Spirit of Wine elevates nothing from this ſpice in diſtillation, the Oil of Pimento being too ponderous to ariſe with ſo light a fluid. The only way of making a ſpirit from it is, to diſſolve ſome of the Oil in pure Spirit of Wine: An agreeable ſpirituous water may be obtained by ſimple diſtillation with proof ſpirit, the watery phlegm in that liquor, carrying up a part of the Oil.

XVI. PEPPER. Black.

BLACK-PEPPER is the fruit of a clim[illegible] plant growing in Malabar, Java, and other par[illegible] the Eaſt-Indies. The eſſential Oil of this Spice [illegible] a ſtrong and a very durable ſmell, but in taſte it is one of the mildeſt of the diſtilled Oils, having no conſiderable pungency or heat. It is elevated in part by rectified Spirit of Wine, the diſt[illegible]

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impregnated with the flavour though not with the pungency of the Pepper. The ſpirituous extract is exceſſively fiery: The watery alſo is very hot and biting, but this menſtruum cannot be made to extract all the hot matter of the Pepper: Four ounces of Pepper treated with more than twenty freſh quarts of water, ſtill retained a biting taſte; what the water extracted, ſo long as it extracted any thing, was likewiſe biting. PEPPER.

Sixteen ounces of Pepper, yielded with water ten ounces of gummy extract, and afterwards with rectified ſpirit three drams of Reſin: Another pound, treated firſt with ſpirit, gave two ounces two drams of reſinous extract; and afterwards with water ſeven ounces four drams two ſcruples of gummy matter: This laſt extract had ſtill ſome degree of pungency, rectified ſpirit ſeeming not to take up all the active parts any ~~more than water~~. Of eſſential Oil, I have gained two drams and a half from a pound.

White. The White-pepper has the ſame kind of taſte and flavour with the black, but in a much leſs degree. It agrees alſo with the black in the nature of its chemical principles, only the flavour reſiding in the diſtilled Oil, and the pungency and heat in the matter left after the diſtillation. In effect, it is the very ſame fruit, gathered before it has grown fully ripe, and freed from the outer ſkin by ſteeping in water and then rubbing it.

XVII. CUBEBS. CUBEBS, *Cubebæ*, are ſmall dried ſhrivelled berries, of Indian growth, greatly reſembling Pepper-corns, but with this difference that each Cubeb is furniſhed with a pedicle, whilſt the Pepper-berries come forth cloſe upon the ſtalk without pedicles: Hence Cubebs are call'd, not improperly, *Piper caudatum*. Of the plant which produces them, we have no ſatisfactory account.

Cubebs are in ſmell ſomewhat different from Pepper, in taſte ſimilar, but leſs pungent. Their eſſential Oil is equally mild; the pungency, as that of Pepper, reſiding in the reſinous parts; but rectified

CUBEBS. ſpirit, which elevates in diſtillation a part of the Oil of Pepper, brings over nothing from Cubebs.

Two ounces of Cubebs yielded with rectified ſpirit five drams ten grains of extract, and afterwards with water four drams thirty-two grains, ſix drams and a half remaining undiſſolved. The ſame quantity, treated firſt with water, gave ſix drams and a ſcruple, and afterwards with ſpirit only one dram and one grain: The reſiduum weighed ſeven drams two ſcruples. Wedel relates that three pounds afford two ounces and a half of eſſential Oil.

XVIII. GRAINS OF PARADISE. GRAINS OF PARADISE have been ſuppoſed to be the ſeeds of the larger Cardamom formerly mentioned (page 187.) but very erroneouſly. In ſmell, taſte, and chemical compoſition, they are quite different from Cardamom-ſeeds. Grains of Paradiſe are pungent as Pepper; and their pungency does not reſide, like that of Cardamoms, in the eſſential Oil, but in the Reſin. The diſtilled Oil poſſeſſes their ſmell, but in taſte proves mild, whilſt the reſinous extract is exceſſively pungent; the ſmalleſt particle ſetting the tongue as it were on fire, and continuing to burn the mouth for ſome hours.

XIX. RHODIUM. ROSEWOOD, *Lignum rhodium, aſpalathus*, a hard ponderous wood, ſaid to be the produce of the iſland Rhodes, and ſome of the Fortunate Iſlands, approaches in ſmell to Roſes, and yields a delightful Oil commonly employed as a perfume. This wood is commonly crooked, twiſted as it were, unequal, and full of protuberances, covered with a rough browniſh-grey bark, which eaſily comes off; the wood itſelf is of a whitiſh colour on the outſide, and of a darker browniſh, yellow, or orange colour within: It is chiefly in this laſt part that the Oil and other active matter reſide, and the yellower the colour the more Oil it contains. The Dutch carefully pick out for diſtillation the largeſt, ſmootheſt, leaſt twiſted and darkeſt coloured pieces. The ſmell of this wood is often not to be diſtinguiſhed in entire pieces, but on ſawing or raſping them acroſs, till we come, to the yellow part, it never fails to diſcover itſelf.

RHODIUM.

Vielheuer relates, that a pound of Rhodium yielded an ounce of Oil: If this be true, the wood muſt have been of an extraordinary good kind. I have gained in England, three drams from a pound, never more, and for the moſt part not near ſo much. The common Oil of Rhodium is grievouſly adulterated, not as ſome ſuppoſe, by adding expreſſed Oils in the diſtillation, for in this caſe they would not ariſe with it, but by mixing them with it afterwards: From an ounce of the very beſt Oil of Rhodium I could procure for money, I ſeparated ſix drams two ſcruples of expreſſed Oil; and there was reaſon to believe that even the remaining four ſcruples were not purely from the Rhodium. The Oil ariſes in diſtillation very ſlowly and difficultly, requires a ſtrong boiling heat, and the diſtillation to be once or twice repeated, by returning the diſtilled water upon the reſiduum. The water is ſtrongly impregnated with the flavour of the Rhodium, and is uſed for the ſame purpoſes as Roſe-water: Rectified ſpirit brings over nothing from this wood, but diſtils a pure flavourleſs ſpirit as it was employed. Hence extracts made by water conſiſt only of the mucilaginous and bitteriſh matter of the wood (for the wood in ſubſtance has a ſenſible bitterneſs,) whilſt the ſpirituous retain all its volatile odorous parts.

An ounce of the raſped wood yielded with rectified ſpirit fifty-five grains of reſinous extract, and afterwards with water thirty grains of Mucilage: The ſame quantity, treated firſt with water, gave forty-five grains of mucilaginous extract, and afterwards with ſpirit twenty-five grains of Reſin: The indiſſoluble woody matter weighed in the firſt caſe ſix drams thirty grains, and in the latter ten grains more.

XX. YELLOW-SAUNDERS.

YELLOW-SAUNDERS, *Santalum citrinum or flavum*, a compact heavy pale yellow wood brought from the Eaſt-Indies, is likewiſe employed principally [redacted] though often alſo medicinally as a corroborant.

YELLOW SAUNDERS. roborant. It has an agreeable ſweet ſmell, ſomewhat of the muſky kind; and yields an Oil of excellent fragrance, though in no very large proportion: From ſixteen ounces of the raſped wood, digeſted ſome days in ſalt water, I obtained by cohobation two drams: It was of a thickiſh conſiſtence, approaching to that of a balſam.

Two ounces of this wood yielded with water two drams of gummy extract, and afterwards with rectified ſpirit one dram and a half of Reſin: Spirit, applied at firſt, extracted from the ſame quantity two drams and a half, and water extracted afterwards one dram. The diſtilled water contained the flavour of the wood, but from this ſmall quantity no actual oil could be collected: The diſtilled ſpirit had no flavour, the reſinous extract retaining all the active parts of the Saunders.

XXI. SASSAFRASS. THE roots of the SASSAFRAS tree, a native of ſeveral parts of America, as Brazil, Florida, Virginia, &c. have a ſtrong aromatic ſmell reſembling that of Fennel. The ſmall branches approach in quality to the roots: the bark of the trunk is much weaker, the wood of the trunk has hardly any ſmell, and is employed only for mechanic uſes. The roots are brought over with the bark upon them, this being much ſtronger in ſmell than the woody part, whereas in ſome other odoriferous woods the bark is inodorous. The wood of Saſſafras is of a browniſh colour; the bark of a reddiſh brown, unequal, eaſy to break: Both are remarkably light.

Boerhaave's obſervation that light woods eaſily exhale their Oil, does not obtain here, notwithſtanding he brings this very wood as an example of it. The oil of Saſſafras ariſes very difficultly in diſtillation with water, and not at all with ſpirit: Notwithſtanding the lightneſs of the wood, the Oil is ſo ponderous as to ſink in water; Hoffman finds that it is the heavieſt of all the eſſential Oils. This gentleman gained, from ſix pounds of the wood, an ounce and ſix drams of Oil: From the ſame quantity of middling Saſſafras I obtained two ounces, ſo that we may

SASSAFRAS.

on at leaſt eight ſcruples upon the pound, or half a ſcruple upon an ounce.

An ounce of Saſſafras digeſted with rectified ſpirit yields four ſcruples of extract, and afterwards with water a dram: Water applied firſt extracts two drams, and ſpirit afterwards only ſeven grains and a half. The Oil is the moſt active part of the Saſſafras, and next to this the ſpirituous extract which contains all the Oil along with the Reſin. Infuſions however, or ſlight decoctions, made like thoſe of Bohea Tea, are no contemptible preparations, the water by this treatment, extracting and retaining greateſt part of the virtue of the root.

The uſe of Saſſafras is almoſt wholly medicinal, as a corroborant, and purifier of the blood. Ximenes relates, and from him Wormius, that this wood macerated for a time in ſea-water, ſweetens or frees it from its ſaltneſs. Franciſcus Redi found from experiment that it had not this effect.

XXII. LIGNUM ALOES.

LIGNUM-ALOES, *Xyloalces*, *Agallcchum*, is an oriental wood, very ſcarce and valuable in the Eaſtern countries, and very rarely brought into Europe, though the compilers of Diſpenſatories direct it as [illegible] in ſundry compoſitions, and require [illegible] freſh and fragrant. The tree has hi[illegible]ed the enquiries of European travellers. It [illegible] that the Lignum-aloes is the medullary part [illegible] tree; and that there are different ſorts of it, of which only the worſt comes to us, the beſt being twice as dear upon the ſpot, as ours is here. Rumphius relates, that the Chineſe, counterfeit it with another Indian wood, boiled, or infuſed, with reſinous aromatic extracts.

Lignum-aloes is very differently deſcribed by different authors. The beſt that we meet with in this country is very compact, heavy, ſomewhat gloſſy, of a cheſnut-brown colour intermixed with a blackiſh and ſometimes a purple, in ſmell reſinous and balſamic: the largeſt, heavieſt, darkeſt coloured, and moſt reſinous pieces are prefered. I have ſeen a veſſel which [illegible] a quart made from one piece.

LIGNUM-ALOES. Half an ounce of this wood, raſped, yielded with rectified ſpirit five ſcruples and a half of reſinous extract, and afterwards with water, one ſcruple of a gummy one : Another half ounce, treated firſt with water, gave three ſcruples and a half, and afterwards with ſpirit one dram : The indiſſoluble woody matter amounted in both caſes to five drams and a half. Hoffmann ſubmitted ten pounds of the raſped wood to diſtillation with water, and obtained only half an ounce of eſſential Oil, which coagulated in the cold into a reſinous or Camphor-like conſiſtence.

XXIII. ELECAMPANE. THE roots of ELECAMPANE, *Enula campana*, *Helenium*, (*Helenium vulgare C. B.*) yield inſtead of a fluid Oil, a ſubſtance which concretes partly into ſnowy flakes, and partly into an unctuous conſiſtent maſs like ſoftiſh Wax.

On diſtilling thirty-two ounces of the root, I gained in all three ſcruples and a half; of which part ſtuck in the head of the ſtill, part in the worm, and part paſſed down into the receiver along with the water. I have not obtained ſuch a concrete from any other vegetable : It is not a true camphor, though agreeing with it in ſeveral properties, as well [illegible] manner of its production. It diſſolves in S[illegible]ine, and is not acted upon by Water : Laid [illegible] coals, it totally exhales : Held over a gentl[illegible] ladle, it flows like wax or tallow, and when [illegible]pears ſofter and more unctuous than at firſt : [illegible] aſſumes a chriſtalline form, but when thoroughly dry proves opake and crumbly : When newly diſtilled, it ſmells conſiderably of the Elecampane, but on keeping for ſome time, it loſes its more ſubtile parts, and no longer diſcovers any remarkable ſmell. I know of no one who has taken notice of this concrete, except the younger Geoffroy, who obſerves that it reſides in the exterior parts of the root, near to the bark.

The taſte of this root is bitteriſh and aromatic : its ſmell moderately ſtrong and not diſagreeable. The moſt active preparation is the ſpirituous extract, rectified ſpirit bringing over nothing in diſtil[illegible]

ELECAMPANE.

the watery extract however is not deſtitute of activity, for water leaves more behind than it carries up. An ounce of the dry root, yielded with water ſix drams and a half of extract: the ſame quantity gave with ſpirit only two drams and a half. After the ſpirit would take up no more, water extracted five drams; but the parcel that had undergone the action of water gave only five grains to ſpirit.

XXIV. SPIKENARD.

INDIAN SPIKENARD, (*Nardus Indica, quæ ſpica, ſpica nardi & ſpica Indica officinis C. B.*) conſiſts of a number of ſlender brittle filaments, ſuppoſed by ſome to be the root, by others the pedicle of the leaves of a plant of the Graſs or Ruſh kind; but which are properly the head of a root, for Pomet mentions and figures a ſpecimen which had great part of the root itſelf adhering.

Spikenard has a very ſtrong, not agreeable ſmell and taſte, ſcarce to be concealed or overpowered by a large admixture of other ſubſtances: In the *Theriaca cæleſtis*, a compoſition of many drugs of ſtrong ſmells and taſtes, Spikenard enters but in ſmall quantity, and yet it prevails over all the others. It contains however only a ſmall proportion of eſſential Oil: On[illegible] ingredi[illegible] ounce, there was only an appearance [illegible] to be tal[illegible]y particles on the ſurface of the water. therto eluc[illegible] ſpirit brings over nothing: The ſpirituous is ſaid, poſſeſſes both the ſmell and taſte of the Spike- of the [illegible] a much greater degree than the watery. An [illegible] yielded a dram of ſpirituous, and afterwards forty ſix grains of watery extract: Water applied at firſt extracted from the ſame quantity four ſcruples, and ſpirit afterwards twenty-five grains: The indiſſoluble reſiduum weighed in both caſes ſix drams ten grains.

XXV. FRENCH LAVENDER.

THE ARABIAN STÆCHAS (*Stæchas purpurea C. B.*) is a ſmall ſhrubby plant, growing not only in Arabia, but in ſome of the ſouthern parts of Europe, particularly in the Stæchades or Hieres iſland on the coaſt of France, the flowery heads or ſpikes are an officinal drug: Theſe, when in perfection, are of a [illegible] ſmell, and a bitteriſh taſte; but they are

not

FRENCH LAVENDER. not gathered it ſeems till they are ready to f[illegible] The dif- flowers, which in drying fall off completely, [illegible]n the nothing to be brought to us [at Berlin] but [illegible]ander inodorous huſks.

An ounce of our beſt Stæchas yielded with rectified ſpirit a dram and twelve grains of extract, and afterwards with water five ſcruples and a half, the reſiduum weighing five drams all but two grains. On inverting the order of procedure, the watery extract weighed three drams ten grains, the ſpirituous only eight grains, and the reſiduum four drams forty grains. The ſpirituous extract contains the whole of the taſte and aromatic flavour: The watery extract taſtes alſo conſiderably of the Stæchas. The diſtilled water has nothing valuable, though the freſh flowers yield a portion of actual Oil.

XXVI. HYSSOP. THE leaves of HYSSOP (*Hyſſopus officinarum cærulea ſive ſpicata C. B.*) yielded a dram and a half of Oil upon two pounds, the diſtilled water retaining alſo a conſiderable quantity, ſo as to ſmell ſtrongly of the herb. Rectified ſpirit elevates the more ſubtile parts of this Oil, but ſoon lets them go upon ſtanding, and loſes nearly all the ſmell which it had when newly diſtilled. The extracts have not much of the diſtinguiſhing taſte, any more than of the ſmell of the Hyſſop: the ſpirituous has more than the watery.

An ounce of the dried leaves gave half an ounce of watery, and afterwards twelve grains of ſpirituous extract: Rectified ſpirit applied at firſt extracted from the ſame quantity two drams, and water afterwards two drams more: the indiſſoluble matter weighed in both caſes half an ounce. This plant is chiefly recommended in coughs and obſtructions the breaſt.

XXVII. FEVERFEW. THE leaves of FEVERFEW (*Matricaria, Parthenium: Matricaria vulgaris ſeu ſativa C. B.* ſo called from their uſe in uterine obſtructions,) have a bitteriſh taſte and a ſtrong ſmell, to moſt people diſagreeable, ſuppoſed to be peculiarly offenſive to bees: whence Paulli adviſes thoſe who expoſe themſelves to theſe inſects to carry Feverfew as a defence.

Feverfew.

[illegible] ſpirit elevates little of the Oil of this plant; [illegible]nce in the ſpirituous extracts, its diſtinguiſhing [illegible]s well as taſte is preſerved. Water on the con[illegible] elevates all the Oil, which partly remains diſſolved in the diſtilled water and communicates to it a ſtrong impregnation, and partly ſeparates in its proper form.

An ounce of the dried leaves yielded with rectified ſpirit three drams five grains of reſinous extract, and afterwards with water five ſcruples of a gummy one: Another ounce, treated firſt with water gave four drams and a ſcruple of gummy extract, and afterwards with ſpirit one dram of Reſin: The reſiduum in the firſt caſe weighed three drams ten grains, in the latter only two drams forty grains.

XXVIII. Rue.

RUE, broad and narrow leaved (*ruta hortenſis latifolia C. B. & Ruta hortenſis altera ejuſdem;*) has a ſtrong diſagreeable ſmell, and a nauſeous, acrid, bitter taſte: ſome have obſerved, that the freſh juicy leaves, bruiſed and applied to the ſkin, corrode and exulcerate it: but that when dry they have not this effect: they are uſed in medicine as a ſtimulating aperient and anthelmintic.

It is ſuppoſed that the ſeeds and their capſules are more active than the leaves. Thus much is certain; that if the plant be diſtilled, ſeeds and all, when the ſeeds are about half ripe, it yields a larger quantity of eſſential Oil than at any other time. It is obſervable of this Oil, that it coagulates in the cold like Oil of Aniſeeds: a property, however, which does not conſtantly obtain, and which perhaps may depend upon the degree of maturity of the ſeeds.

Two ounces of the dried leaves yielded with rectified ſpirit five drams and a half of extract, and afterwards with water five drams wanting half a ſcruple, the reſiduum weighing five drams two ſcruples: Water applied firſt extracted from the ſame quantity nine drams, and ſpirit afterwards only two ſcruples, the reſiduum amounting to ſix drams and a ſcruple. The extracts made both by water and ſpirit at firſt, [illegible] bitter and acrid: the firſt ſpirituous is ſomewhat

oily;

RUE. oily; the ſecond watery is manifeſtly ſaline. [illegible] tilled ſpirit has little or no impregnation [illegible] Rue.

XXIX. **SCORDIUM.** THE leaves of SCORDIUM or Water ger[illegible] five (*Chamædrys paluſtris caſcens ſeu ſcordium offic*[illegible] *Tourn.*) have a bitteriſh taſte, and a ſtrong ſmell reſembling that of Garlic. In diſtillation, however, we cannot, from moderate quantities, collect any actual Oil, its proportion being very ſmall, ſo as to be almoſt wholly retained in the diſtilled water, to which it communicates the ſmell of the herb. Both the watery and ſpirituous extracts are bitter: the ſpiritous is the ſtrongeſt, and poſſeſſes the ſmell and flavour as well as the bitterneſs of the Scordium, pure ſpirit elevating nothing of its Oil in diſtillation.

An ounce of the dried leaves of Scordium yielded with water four drams and a half of gummy extract, and afterwards with rectified ſpirit fifteen grains of Reſin. Another ounce, treated firſt with ſpirit, gave three drams of reſinous extract, and afterwards with water five ſcruples and a half of gum: The reſiduum in the firſt experiment weighed three drams fifteen grains, in the latter five grains leſs.

This plant is greatly celebrated as a diaphoretic and alexipharmic: In theſe intentions an eſſence or ſpirituous tincture of it is frequently made uſe of in Germany. A tincture made in highly rectified ſpirit contains more of the active parts of the Scordium, than one made with a phlegmatic ſpirit, though the latter, by diſſolving more of the mucilaginous parts, proves thicker and apparently more ſaturated: the firſt tincture is of a fine green colour, the other inclines more to a dark browniſh.

CLASS VII.

SALINE VEGETABLES.

I. **SALINE.** Lemon juice, &c. THE acid juices of fruits, as Citrons and Lemons, effervesce with and neutralize alcalies, diſſolve the abſorbent earths, and ſome [illegible]

SALINE.

dies, as Iron, Copper, and Lead; they contain, beſides their truly acid part, a large quantity of groſs [illegible]ginous or unctuous matter: Hence the juices ſia; t[illegible]lves, and moſt of the ſolutions made in them, [illegible]pt to grow ſoon mouldy in keeping. The metallic ſolutions are leſs ſubject to this inconvenience than the earthy, and ſome juices leſs than others: A ſolution of iron in the juice of the apples called Golden Pennets, evaporated to a thick conſiſtence, proves an elegant Chalybeate, which keeps well. The juices give over very little acid in diſtillation; nor have they been obſerved to chriſtallize into a ſolid Salt, like thoſe of ſome acid herbs as Wood-ſorrel (l).

II. SORREL.

WOOD-SORREL (*Acetoſella, lujula, alleluja, oxys: Trifolium acetoſum vulgare flore albo C. B.*) is a ſmall plant growing wild in woods and meadows: It is ſaid to cover itſelf with its leaves on the approach of ill weather. The freſh leaves have a mild acid taſte, much more agreeable than that of common Sorrel, without any remarkable ſmell. Their expreſſed juice is employed medicinally for cooling and quenching thirſt; and the eſſential ſalt, extracted from it by chriſtallization, for taking out iron moulds and ſpots of ink from linnen; for this purpoſe, the ſtained part is dipt in water, ſprinkled with a little of the powdered Salt; then rubbed on a pewter-plate, after which the ſpot is waſhed out with warm water.

Twenty pounds of freſh Sorrel-leaves yielded ſix pounds of juice; from which were obtained two ounces two drams and one ſcruple of cryſtalline Salt,

together

(l) *Do not cryſtallize.*] It appears to be the mucilaginous parts of theſe juices that prevent the cryſtallization of the ſaline; and that the ſaline parts are capable of being purified from the mucilaginous. From the juices of Oranges and Lemons, I have ſeparated the inſipid Mucilage, and obtained the acid matter in form of a truly cryſtalline white Salt. Probably by the ſame management, the acid and ſweet juices of other fruits might be made to afford perfect Salts retaining all the ſpecific taſte of the fruit.

How far the native acid juices agree or diſagree with Vinegar and Tartar, the products of fermention is little known. They ſeem to approach neareſt to the nature of Tartar, as being ſuſceptible of a cryſtalline form, giving over little of their acid in diſtillation, and yielding in the reſiduum, a large portion of fixed alcali.

Sorrel.

gether, with two ounces and ſix drams of an impure ſaline maſs. The matter remaining after the expreſſion, being treated with water and with ſpirit, [illegible] ounces and a half of watery, and afterwards, with drams of ſpirituous extract: The indiſſoluble [illegible] from the whole twenty pounds, amounted to no more than three ounces and three drams.

The eſſential Salt has a great agreement with Tartar, and yields the ſame products on being examined by fire. It is not, however, as ſome pretend, a true Tartar: The principal differences are, that it is ſenſibly more acid, turns Syrup of Violets red, whilſt Tartar makes no change in the colour, contains leſs oily matter, diſſolves more eaſily in water, and does not ſeparate from the ſolution. It holds near a dram of Oil upon the ounce: On diſtilling an ounce in a retort, a ſcruple of Oil is obtained in its proper form, the other two ſcruples being partly diſſipated in the operation, and partly imbibed by the ſpirit that comes over at the ſame time.

III. Casia.

THE ſweet ſaline ſubſtance of Casia Fistularis (for it appears to be truly of the ſaline kind) diſſolves not only in water but in rectified Spirit of Wine. Caſia is the fruit of a tree growing in Egypt and in both the Indies: It is a large cylindrical pod or cane, containing, under a hard rind, a ſoft pulp lodged in a number of tranſverſe cells, with a flat roundiſh ſeed in each. The pulp is apt to grow ſour or mouldy upon long keeping, even before its extraction from the cane: Sometimes alſo it grows dry, ſo as that the ſeeds rattle in the cells upon ſhaking the pod; in this ſtate it is generally rejected, though the ſimple exſiccation cannot be of any prejudice, as nothing but the aqueous humidity exhales.

The pulp of Caſia, when in perfection, is of a ſhining black colour, a ſweet taſte followed by a diſagreeable reliſh, and a faint unpleaſant kind of ſmell. It is commonly extracted by bruiſing the pod, boiling it in water, and evaporating the ſtrained decoction to a due conſiſtence. Out of four drams of the dry pulp, water diſſolved three drams fifteen gra[illegible]

Casia.

ſpirit as much or very nearly ſo; but the ſpirit acted more ſlowly and difficultly than the water. [illegible] diſtilled water ſmelt and taſted a little of the Ca[illegible]he ſpirit not.

[illegible]his pulp is a gentle laxative, and very frequently uſed in that intention by the French: The doſe, to an adult, is two ounces diſſolved in ſome convenient liquor with the addition of a carminative to prevent its occaſioning flatulencies and gripes, which of itſelf is very apt to do, eſpecially when grown ſouriſh. It is ſaid to tinge the urine, when taken in moderate quantity, green; and in a larger quantity, brown or blackiſh.

IV. Carob.

The Carob, *Caroba, ceratia, ſiliqua dulcis*, is a pod of the ſame kind, about a ſpan long, of a flatiſh figure, containing a brown coloured ſweet pulp, which is uſed by the Egyptians and Arabians as Sugar. The tree is found wild alſo in ſome of the ſouthern parts of Europe: It is raiſed among us in the gardens of the curious, but does not in this climate ripen its fruit.

The pulp of the Carob is diſſolved more effectually by water than by ſpirit. Out of ſixteen drams of the dry pulp, water took up eleven drams; rectified ſpirit extracted from the remainder only five grains, leaving five drams of mere ſhells or membranes. The ſame quantity, treated firſt with ſpirit, gave out but nine drams ten grains, and afterwards to water five ſcruples, five drams and ten grains being left. The watery extract is ſweeter and more agreeable than the ſpirituous: The ſpirituous extract made after water is manifeſtly unctuous: The watery extract made after ſpirit diſcovers ſome ſaline matter. The watery decoctions are of a reddiſh brown colour, and in inſpiſſation turn almoſt black; the fruit gives a deep colour to many freſh parcels of water. Spirit on the other hand ſoon ceaſes to extract any tincture, and the firſt deepeſt tincture is only of a yellowiſh-brown: Nevertheleſs, the ſpirituous extract made after water inclines to black.

V. LIQUORICE. IT is probable that the ſweetneſs of LIQUORICE, and of vegetable ſweets in general, depends on a ſaline ſubſtance of the nature of Sugar, in[illegible] blended, as Sugar is in the juice of the can[illegible] unctuous, mucilaginous, or reſinous matter. [illegible]fied Spirit of Wine diſſolves the ſaccharine Salts; and as it takes up but little of the mucilaginous principle (the ingredient whoſe quantity is the greateſt,) the ſpirituous tinctures and extracts prove conſiderably ſweeter than the watery. The ſpirituous extract of Liquorice is exceedingly ſweet, the watery far leſs ſo. From two ounces of the dry root I obtained by rectified ſpirit only five drams, whilſt the ſame quantity yielded with water nine drams: After the ſpirit would take up no more, water extracted three drams and a half; but after the action of water, ſpirit gained only half a dram: The indiſſoluble earthy matter amounted in the firſt caſe to ſeven drams and a half, in the latter only to ſix and a half. The ſweetneſs of this root is accompanied with a ſlight bitteriſhneſs, which ſome ſuppoſe to be confined to the outer brown ſkin, but which is found to be equally diſtributed through the inner yellow part: The peeling of Liquorice is therefore entirely unneceſſary, unleſs for obtaining a paler coloured powder or a lighter tincture.

It has been ſaid, that Liquorice is indiſpoſed to ferment, and hence it is recommended particularly to thoſe, who cannot well bear Sugar, Honey, or the more fermentable ſweets: Experiment ſhews however that it does ferment, and yield a truly vinous liquor.

The extract of Liquorice is a conſiderable article of commerce: It is made in large quantity in Spain, and in ſome parts of Germany, particularly at Bamberg. The Spaniſh, which is generally covered with Bay leaves, is the beſt and pureſt; the other has a large admixture of the rob or inſpiſſated juice of Plums, &c. A certain writer affirms that an ounce of the Bamberg extract, treated with water [illegible], will ſcarcely give out two drams, but I have never met with any ſo bad as this: An ounce [illegible] wards, of ſeven drams, though it does not follow that the whole of that quantity was genuine extract of Liquorice, as the rob of Plums will diſſolve in water as well as that of Liquorice. **Liquo-rice.**

Out of an ounce of the Spaniſh extract, water diſſolved ſeven drams two ſcruples, only one ſcruple being left, from which ſpirit extracted nothing: Rectified ſpirit diſſolved but four drams two ſcruples out of an ounce; water extracted three drams from the reſiduum, a ſcruple remaining as before undiſſolved. An ounce of the Bamberg ſort yielded with water ſeven drams one ſcruple: The ſame quantity gave with ſpirit two drams fifty grains, and afterwards with water three drams and a half; two ſcruples in the former, and five in the latter caſe, remaining undiſſolved. The part which ſpirit took up, contained nearly all the ſweetneſs; that which water extracted afterwards having ſcarcely any taſte. The Dutch ſupply us now with no ſmall quantity of what is called Spaniſh Liquorice, and do not fail to wrap it up in plenty of Bay-leaves.

VI. Mullein. THE flowers of many plants are remarkably ſweet: Thoſe of Mullein (*Verbaſcum mas latifolium luteum C. B.*) contain a Honey-like juice. An extract made by water from the flowers is exceedingly ſweet and pleaſant: In the ſpirituous extract, a kind of peculiar flavour is joined to the ſweetneſs. Twenty-four drams of the flowers yielded with water twelve drams and a half, and afterwards with rectified ſpirit one dram and a half: Spirit applied firſt, extracted from the ſame quantity nine drams, and water afterwards four and a half. The leaves of Mullein have no ſweetneſs, and contain leſs diſſoluble matter than the flowers: Twenty-four drams gave eight and a half of watery, and afterwards one and a half of ſpirituous extract: On inverting the order of applying the menſtrua, the ſpirituous extract weighed four drams and a half, and the watery ſix.

ANOMALOUS VEGETABLES.

Arum. THERE are ſome vegetables which cannot be referred to any of the foregoing claſſes, nor in-

Arum. deed to any other, the principle, in which their peculiar qualities reſide, being as yet wholly unknown. The common Arum or Wakerobin is a plant of extreme acrimony: The freſh root, ſlightly chewed, ſeems to burn and corrode the tongue; and often times its pungent impreſſion continues for two or three days. The ſeat of this acrimony has hitherto eluded our enquiries: The diſtilled water and ſpirit have nothing of it, and the watery and ſpirituous extracts exceeding little; and yet the root is by theſe operations deprived of it.

Greateſt part of the acrimony is deſtroyed by ſimple exſiccation: The dry root appears white and farinaceous, and affects the tongue but little. In this ſtate it is given medicinally for attenuating viſcid juices: Formerly it was uſed as ſtarch for linen, before the diſcovery of that from wheat (m), and is ſaid to have occaſioned a rawneſs and ſoreneſs of the hands very diffcultly relievable by ointments: In ſome parts of France, it is ſtill employed in bleaching, being ſuppoſed, by its corroſive quality to diſſolve unctuoſities and make the linen white.

From an ounce of the dry root I obtained ſcarcely a ſcruple of ſpirituous extract: The ſame quantity yielded of watery extract, near three drams. The firſt had ſome ſlight pungency; the latter none.

Lycopodium. The fine duſt of Lycopodium, or Puff-ball, is called, by ſome, on account of its great inflammability, vegetable Sulphur. The Puff ball is the ſeed-veſſel of a ſpecies of Moſs named by Tournefort *Muſcus ſquamoſus vulgaris repens clavatus*; and the duſt is properly the ſeeds of the plant. There are ſundry other vegetables, as Polypodies, Ferns, Coniferous trees, *&c.* whoſe ſeeds are a like yellow, impalpable Farina, ſo ſubtle as to be blown away by the leaſt motion of air: It is this duſt which has given riſe to ſome reports of ſhowers of Brimſtone.

(m) *Starch.*] Common Starch is prepared by macerating Wheat in water renewed once or twice a day, till it burſts eaſily betwixt the fingers and gives out a kind of white Creme: This, ſqueezed through a canvas bag, and macerated with freſh parcels of water, forms a tenacious fecula; which, after the water is poured off, is taken out in pieces and dried ſlowly in the ſun. A method has lately been diſcovered and communicated in the Swediſh Tranſactions of making Starch from Potatoes. For this purpoſe, the Potatoes are laid in water twelve hours, then ſkinned, ſoaked again for two hours longer, afterwards ground, moiſtened, preſſed through a hair-ſieve, the pulpy matter boiled with water, ſuffered to ſettle, and treated with freſh parcels of water till the liquor comes off as clear as it was put on: When the laſt water is poured off, the remaining Starch is dried in the ſun, or other very gentle heat. By this proceſs, five pounds of Potatoes yielded eight ounces and three quarters of fine Starch, and one ounce of coarſe. Boiled Potatoes did not ſucceed.

Lycopodium.

The duſt of Lycopodium, diffuſed or ſtrewed in the air, takes fire from a candle, and burns off like a flaſh of lightning, with a conſiderable noiſe: A quantity laid together upon burning coals does not flame, but ſmokes away with a fetid ſmell: Burnt in a red-hot crucible, it leaves a very ſmall proportion of a light cobweb-like matter. It does not, as ſome report, take fire from Flint and Steel, nor explode like Gunpowder; nor does it ſeem to detonate more violently with Nitre than other inflammable matters do. Olearius relates, that the Ruſſians employ much of it in fire-works, but does not inform us in what manner.

This ſubſtance, chemically analyſed appears to contain a reſinous matter, and an oily one of the expreſſible kind, intimately combined together, ſo as to be both extracted, at leaſt in part, by rectified Spirit of Wine: On inſpiſſating the tincture, the Oil ſeparated, remained permanently fluid, and would not unite again even with the reſinous extract: It is remarkable that pure ſpirit would no longer touch this Reſin any more than the Oil. The quantity thus extracted from an ounce of the powder amounted only to a dram: Water did not take up near ſo much; it was with great difficulty I obtained by water eight grains of extract from an ounce. Both the water and ſpirit aroſe in diſtillation unchanged.

By deſtructive diſtillation in an open fire, I gained a large proportion of empyreumatic Oil, no leſs than two ounces and a half from four: This was preceded, not by an acid liquor which moſt vegeta-

LYCOPODIUM. bles yield on the ſame treatment, but by an urinous one; the black Coal remaining in the bottom of the diſtilling veſſel weighed five drams.

CORK. AS CORK ſtoppers ſometimes affect the colour or the taſte of liquors, it may be proper to beſtow ſome experiments on this ſubſtance in that view. Cork is the bark of a tree of the Oak kind growing in France, Italy, Spain, and ſome other parts of Europe: The French Cork is the whiteſt, the Spaniſh the ſofteſt and moſt eſteemed. The bark is taken off every three years, preſſed flat, dried, and then ſcorched on the outſide to preſerve it from inſects.

Cork boiled in water communicated a browniſh colour, and on evaporating the decoctions, there remained two ſcruples of ſolid extract from an ounce: The reſiduum, digeſted in rectified ſpirit, gave out eleven grains. Spirit applied at firſt extracted two ſcruples and two grains from an ounce, and water afterwards eight grains. The ſpirituous tincture was yellowiſh, paler in colour than the watery, but ſtronger in taſte: From all the ſpirituous tinctures a powdery matter, precipitated, of a reddiſh colour from thoſe made at firſt, and of an aſh-grey when the Cork had been previouſly treated with water.

I likewiſe macerated ſmall pieces of Cork in different liquors ſet in a gently warm place: Diſtilled Vinegar and Spirit of Vitriol were tinged the leaſt; Aqua fortis became ſomewhat yellower, and almoſt wholly corroded and diſſolved the Cork; dulcified Spirit of Vitriol, ſolution of common Salt, dulcified Spirit of Nitre, Spirit of Sea-ſalt, Lime-water, and dulcified Spirit of Sea-ſalt, acquired, (in the order they are here enumerated) more and more of a yellowiſh tinge; Syrup of Violets, dulcified Spirit of Sal ammoniac, and Tincture of Tartar, gained a deeper browniſh-yellow: watery Spirit of Sal ammoniac. Oil of Tartar per deliquium, and vinous Spirit of Sal ammoniac with Quick-lime, received the deepeſt reddiſh tincture of all the liquors examined. In ſundry tinctures, which had been paſſed through a filter and appeared perfectly clear, Cork occaſioned a ſenſible turbidneſs and precipitation, particularly Tinctura Tartari, which diſſolves a conſiderable quantity of the Cork. The change of colour of Syrup of Violets is not a little extraordinary. Cork.

Cotton. Cotton (*n*), affords not one of thoſe principles on which

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(*n*) *Cotton.*] In the Swediſh Tranſactions for the year 1747, a method is given of preparing Flax ſo as to reſemble Cotton, in whiteneſs and ſoftneſs, as well as in coherency. For this purpoſe a little ſea-water is directed to be put into an iron pot or an untinned copper kettle, and a mixture of equal parts of Birch aſhes and Quick-lime ſtrewed upon it: A ſmall bundle of Flax is to be opened and ſpread upon the ſurface, and covered with more of the mixture, and the ſtratification continued till the veſſel is ſufficiently filled. The whole is then to be boiled with ſea-water for ten hours, freſh quantities of water being occaſionally ſupplied, in proportion to the evaporation, that the matter may never become dry. The boiled Flax is to be immediately waſhed in the ſea, by a little at a time, in a baſket, with a ſmooth ſtick: When grown cold enough to be borne by the hands it muſt be well rubbed, waſhed with Sope, laid to bleach, and turned and watered every day. Repetitions of the waſhing with Sope expedite the bleaching; after which the Flax is to be beat in again well waſhed: When dry it is to be worked and carded in the ſame manner as common Cotton, and preſſed betwixt two boards for twice twenty-four hours. It is now fully prepared and fit for uſe: It loſes in this proceſs near one half of its weight, which is abundantly compenſated by the improvement made in its quality.

The filamentous parts of different vegetables have been employed in different countries, for the ſame mechanic uſes as Hemp and Flax among us. Putrefaction deſtroys the pulpy or fleſhy matter, and leaves the tough filaments entire: By curiouſly putrefying the leaf of a plant in water, we obtain the fine flexile fibres, which conſtituted the baſis of the ribs and minute veins, and which now form as it were a ſkeleton of the leaf. Alcaline Lixivia, in ſome degree, produce ſimilar effects to putrefaction.

The Sieur de Flacourt, in his Hiſtory of Madagaſcar, relates that different kinds of cloth are prepared, in that iſland, from the filaments of the bark of certain trees boiled in ſtrong Ley; that ſome of theſe cloths are very fine, and approach to the ſoftneſs of Silk, but in durability come ſhort of Cotton; that others are coarſer and ſtronger, and laſt thrice as long as Cotton; and that of theſe the ſails and cordage of his veſſel were made.

The ſame author informs us, that the ſtalks of Nettles are uſed for the like purpoſes in his own country, France. And Sir Hans Sloane relates, in one of his letters to Mr. Ray, that he has been informed by ſeveral, that Muſlin and Callico, and moſt of the Indian linens, are made of Nettles.

In ſome of the Swediſh provinces, a ſtrong kind of cloth is ſaid to be prepared from Hop-ſtalks: And in the Tranſactions of the Swediſh Academy for the year 1750, there is an account of an experiment made in conſequence of that report. Of the ſtalks, gathered in Autumn, about as much was taken, as equalled in bulk a quantity of Flax, that would have produced a pound after preparation. The ſtalks were put into

Cotton.

which the foregoing arrangement of vegetables is built. It gives out no gummy or ſaline matter to water, no reſinous matter to ſpirit, and no Oil in diſtillation; and ſeems in theſe kinds of experiments, a a ſimple vegetable fibre. The force of fire, however, converts it like all other vegetable bodies into diſſimilar parts; and here it is found to be remarkably different from the animal filaments, Wool, Hair, and Silk. It does not, like them, yield a fetid ſmell when burnt in the open air, nor any urinous Salt or Spirit in cloſe veſſels (o). Eight ounces of Cotton, diſtilled

in

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water, and kept covered therewith during the winter: In March they were taken out, dried in a ſtove, and dreſſed as Flax. The prepared filaments weighed very nearly a pound, and proved fine, ſoft and white: They were ſpun and woven into ſix ells of fine ſtrong cloth. The author, Mr. Schiſler, obſerves, that Hop-ſtalks take much longer time to rot than Flax; and that if not fully rotted the woody part will not ſeparate, and the cloth will neither prove white nor fine.

(o) *Difference from Wool,* &c.] Vegetable filaments, and thread or cloth prepared from them, differ remarkably from Wool, Hair, Silk, and other animal productions, not only in the principles into which they are reſoluble by fire, but likewiſe in ſome of their more intereſting properties, particularly in their diſpoſition to imbibe colouring matters; ſundry liquors, which give a beautiful and durable dye to thoſe of the animal, giving no ſtain at all to thoſe of the vegetable kingdom.

A ſolution of Copper in Aqua fortis, which had been changed blue by an addition of volatile ſpirit, on being mixed with a little ſolution of Tin, became turbid and greeniſh. Pieces of white Silk and Flannel, boiled, without any previous preparation, in this mixture, received a bright deep yellow dye, whilſt pieces of Linen, prepared and unprepared, came out as colourleſs as they were put in.

Fiſhing-nets are uſually boiled with Oak bark or other like aſtringents, which render them more laſting. Thoſe made of Flax receive from this decoction a browniſh colour, which by the repeated alternations of water and air, is in a little time diſcharged, whilſt the fine gloſſy brown, communicated by the ſame means to ſilken nets, permanently reſiſts both the air and water, and ſtands as long as the animal filaments themſelves. In like manner the ſtain of Ink, or the black dye from ſolutions of Iron mixed with vegetable aſtringents, proves durable on Silk and Woollen; but from Linen, the aſtringent matter is extracted by waſhing, and only the yellow iron mould remains.

The red decoction of Cochineal, which, heightened with a little ſolution of Tin, gives the fiery ſcarlet dye to Wool or Silk that have been previouſly impregnated with ſolution of Tartar, makes no impreſſion upon Linen or Cotton prepared in the ſame manner. Mr. du Fay informs us in the Memoirs of the French Academy for the year 1737, that having prepared a mixed cloth whoſe warp was of Wool, and the woof of Cotton, and thoroughly blended the two together by fulling, he ſtill found the Cotton to reſiſt the action of the ſcarlet liquor, and the

Wool

COTTON.

in a retort, gave over three ounces and a half of an acidulous, fuliginous, oily Spirit, and about five drams of an empyreumatic Oil: The remaining coal, burnt in a crucible into white aſhes, weighed no more than four ſcruples, from which was obtained a ſmall portion of fixed alcaline Salt.

Cotton is the produce of a middling ſized tree, which grows ſpontaneouſly in both the Indies; the ſeeds of the tree are bedded in this ſoft ſubſtance, with an outer ſhell over it. There are many other plants which bear a downy or cottony matter: But the down is in moſt of them unfit for being manufactured like Cotton; the fibres being too coarſe, or too ſhort, to be ſpun into fine threads. There is a Cotton-plant in the Eaſt-Indies, whoſe down can be employed only for ſtuffing beds, and differs from the common Cotton more remarkably in a great degree of inflammability: When it catches fire, it is ſaid to be almoſt inſtantaneouſly and unextinguiſhably conſumed (*n*).

SECT.

Wool to receive the ſame colour from it as Wool by itſelf, the ſtuff coming out all over marbled, fiery and white.

Many other inſtances of this kind are known too well to the Callico-printer; whoſe grand deſideratum it is, to find means of making Linen receive the ſame colours that Wool does. The phyſical cauſe of the difference is wholly unknown; and indeed of the theory of dyes in general we know as yet extremely little. Are animal filaments tubular, and the colouring atoms received within them? Are vegetable filaments ſolid, and the colour depoſited on the ſurface? Or does not their different ſuſceptibility of colour depend rather on the different intrinſic properties of the two? There are many inſtances of a like diverſity, even in the metallic kingdom, where a mechanical difference in texture, can ſcarcely be preſumed to be the cauſe; Thus Silver receives a deep ſtain from ſulphureous or putrid vapours, or the yolk of a boiled egg, which have no effect upon Tin.

(*n*) ADDITIONAL ARTICLES.

THERE are many vegetable ſubſtances, beſides thoſe above-mentioned, whoſe conſtituent principles are as yet ſo imperfectly known, that we cannot, with propriety, either refer them to any of the preceding claſſes, or form any others that ſhall comprehend them. Such are particularly the coloured flowers, leaves, &c. of plants, conſidered merely as ſubjects of colour. And indeed moſt of the vegetable colours might, perhaps, be properly ranked here; for though the colouring matter ſeems in many, from its being extracted by water, to be of the gummy or gummy reſinous kind, yet, as it is procurable alſo in the form of a lake

not

Cotton. not at all diſſoluble either by Water or by Spirit, it cannot ſtrictly be looked upon either as reſinous or gummy.

FLOWERS.

AMONG the infinite variety of colours, which glow in the flowers of plants, there are very few which have any durability, or whoſe fugitive beauty can be arreſted by art, ſo as to be applied to any valuable purpoſes. The only permament ones are the yellow, the red, the blue, and all the intermediate ſhades of purples, crimſons, violets, *&c.* are extremely periſhable. Many of theſe flowers loſe their colour on being barely dried; eſpecially if they are dried ſlowly, as has been uſually directed, in a ſhady and not warm place. The colours of all of them periſh, on keeping, even in the cloſeſt veſſels. The more haſtily they are dried, and the more perfectly they are ſecured from the air, the longer they retain their beauty. The colouring matter, extracted and applied on other bodies, is ſtill more periſhable: Oftentimes it is changed or deſtroyed in the hands of the operator.

BLUE FLOWERS.

THE colour of many blue flowers is extracted by infuſion in Water; but there are ſome, from which Water gains only a reddiſh or a purpliſh hue. Of thoſe that have been tried, there is not one which gives any blue tincture to ſpirituous liquors: Some give no colour at all, and ſome a reddiſh one. The juice, preſſed out from the freſh flowers, is for the moſt part blue.

The blue juices and infuſions are changed red by all acids: The marine acid ſeems to ſtrike the moſt florid red. The flowers themſelves, macerated in acid liquors, impart alſo a deep red tincture. Alcalies, both fixed and volatile, and Lime-water, change them to a green. Thoſe infuſions of juices, which have nothing of the native colour of the flower, ſuffer the ſame changes from the addition of acid and alcaline liquors: Even when the flowers have been kept till their colour is loſt, infuſions made from them acquire ſtill a red colour from the one, and a green from the other, though in a leſs degree than when the flowers were freſh.

The red colour produced by acids, is ſcarcely more durable than the original blue: Applied upon other bodies, and expoſed to the air, it gradually degenerates into a faint purpliſh, and at length diſappears, leaving hardly any ſtain behind. The green produced by alcalies, changes to a yellow, which does not fade ſo ſoon. The green, by Lime-water, is more permanent and more beautiful: Green lakes, prepared from theſe flowers by Lime-water, have been uſed as pigments by the painter.

The flowers of Cyanus have been greatly recommended, as affording elegant and durable blue pigments; but I have never been able to extract from them any blue colour at all. They retain their colour indeed, when haſtily dried, longer than ſome other blue flowers: but they communicate nothing of it to any kind of menſtruum. Infuſions of them in watery, ſpirituous, and oily liquors, are all, more or leſs of a reddiſh caſt, without any tendency to blue. Alum, which is ſaid to heighten and preſerve their blue colour, changes it, like that of other blue flowers, to a purpliſh red; acids to a deep red: alcalies and Lime-water to a green. Solution of tin, added to the watery infuſion, turns it to a fine crimſon: On ſtanding, a beautiful red fecula ſubſides, but it loſes all its colour by the time it is dry. The watery infuſion, inſpiſſated to the conſiſtence of an extract, appears of a dark reddiſh brown: An extract made with rectified Spirit is of a purpliſh colour. The colour of both extracts, ſpread thin and expoſed to the air, quickly fades——The flowers employed in theſe experiments were thoſe of the common blue bottle of the cornfields, *Cyanus ſegetum* C. B. *Centaurea calycibus ſerratis: foliolis linearibus integerrimis: infimis dentatis* Linn. Spec.

RED FLOWERS.

RED flowers readily communicate their own red colour to watery menſtrua: Among thoſe that have been tried there is not one exception. Thoſe of a full red colour, give to rectified Spirit alſo a deep red tincture, brighter, though ſomewhat paler than the watery infuſion: But the lighter red flowers, and thoſe which have a tendency to purpliſh, impart very little colour to Spirit, and ſeem to partake more of the nature of the blue flowers than of the pure red.

Infuſions of red flowers are ſuppoſed to be heightened by acids, and turned green by alcalies like thoſe of the blue: But this is far from being univerſal. Among thoſe I have examined, the roſe colours and purpliſh reds were all changed nearly in the ſame manner as the blues; but the full deep reds were not. The deep infuſion of red Poppies is turned by alcalies not to a green, but to a duſky purple.

YELLOW FLOWERS.

THE colours of yellow flowers, whether pale or deep, are in general durable: Many of them are as much ſo, perhaps, as any of the native colours of vegetables. The colour is extracted both by Water and by Spirit: The watery infuſions are the deepeſt. Neither acids nor alcalies alter the ſpecies of colour, though both of them vary its ſhade; acids rendering it paler, and alcalies deeper: Alum likewiſe conſiderably heightens it, though not ſo much as alcalies.

Wool or Silk, impregnated with a ſolution of Alum and Tartar, receives, on being boiled with the watery infuſion or decoction, a durable yellow dye, more or leſs deep according as the liquor is more or leſs ſaturated with the colouring matter. An infuſion of the flowers made in alcaline Ley, precipitated by Alum, gives a durable yellow lake. Some of theſe flowers, particularly thoſe of the *Chryſanthemum* or Corn-marigold, appear (from the *Ars tinctoria fundamentalis* publiſhed by Stahl) to be made uſe of by the German dyers.

In ſome of the deep reddiſh yellow or orange-coloured flowers, the yellow matter ſeems to be of the ſame kind with that of the pure yellow flowers, but the red to be of a different kind from the pure red ones: Watery menſtrua take up only the yellow, and leave the red, which may afterwards be extracted by rectified Spirit of Wine, or by Water acuated with fixed alcaline Salt. Such particularly are the ſaffron coloured flowers of Carthamus. Theſe, after the yellow matter has been extracted by Water, are ſaid to give a red tincture to Ley; from which, on ſtanding at reſt for ſome time, a deep bright red fecula ſubſides; called, from one of the names of the plant which produces it, Safflower; and from the countries whence it is commonly brought to us, Spaniſh-red and China-lake. This pigment impregnates Spirit of Wine with a beautiful red tincture, but communicates no colour to Water.

I have endeavoured to ſeparate, by the ſame treatment, the red matter of ſome of the other reddiſh yellow flowers, as thoſe of the garden Marigold; but without ſucceſs. Plain Water extracted a yellow colour, and alcaline Ley extracted afterwards only a paler yellow: Though the digeſtions were continued till the flowers had loſt their colour, the tinctures

FLOWERS.

were no other than yellow, and not ſo deep as thoſe obtained from the pure yellow flowers.

The little yellow floſculi, which in ſome kinds of flowers are collected into a compact round diſc, as in the Daiſy and Corn-marigold, agree, ſo far as they have been examined with the expanded yellow petala. Their colour is affected in the ſame manner by acids, by alcalies, and by Alum: and equally extracted by Water and by Spirit.

But the yellow farina, or fine duſt lodged on the tips of the ſtamina of flowers, appears to be of a different kind. It gives a fine bright yellow to Spirit, and a duller yellow to Water; the undiſſolved part proving in both caſes of a pale yellowiſh white. Both the watery and ſpirituous tinctures were heightened by alcaline liquors, turned red by acids, and again to a deep yellow on adding more of the alcali. I know no other vegetable yellow that is changed red by acids.

WHITE FLOWERS.

WHITE flowers are by no means deſtitute of colouring matter. Alcaline lixivia extract from ſome of them a green tincture, and change their colourleſs expreſſed juices to the ſame colour; but I have not obſerved that they are turned red by acids. The flowers of the common wild Convolvulus or Bindweed, which in all their parts are white, give a deep yellow or orange tincture to plain Water, which like the tinctures of flowers that are naturally of that colour, is rendered paler by acids, heightened a little by Alum, and more conſiderably by Alcaline Salts. The vapours of the volatile vitriolic acid, or of burning Sulphur, which whiten or deſtroy the colour of the coloured flowers, make no change in the white.

FRUITS.

THE red juices of Fruits, as red Currants, Mulberries, Elderberries, Morello and Black Cherries, &c. gently inſpiſſated to dryneſs, diſſolve again almoſt totally in Water, and appear nearly of the ſame red colour as at firſt. Rectified Spirit extracts the tinging particles, leaving a conſiderable portion of mucilaginous matter undiſſolved: And hence the ſpirituous tincture proves of a brighter colour than the watery. The red ſolutions, and the juices themſelves, are ſometimes made dull and ſometimes more florid, by acids; and generally turned purpliſh by alcalies.

The colours of theſe juices are for the moſt part periſhable. They reſiſt indeed the power of fermentation, and continue almoſt unchanged after the liquor has been converted into Wine: But when the juice is ſpread thinly on other bodies, exſiccated, and expoſed to the air, the colour quickly alters and decays: The bright lively reds change the ſooneſt: The dark dull red ſtain from the juice of the Black-cherry is of conſiderable durability. The fruit of the American Opuntia or prickly Pear, the plant upon which the cochineal inſect is produced, is perhaps an exception: This bright red fruit, according to Labat, gives a beautiful red dye. Some experiments however made upon the juice of that fruit, as brought into England, did not ſeem to promiſe any great advantage from it; but the particulars I cannot now recollect.

The ripe berries of Buckthorn ſtain paper of a green colour. From theſe is prepared the ſubſtance called Sap-green, a pigment ſufficiently durable, readily ſoluble in Water, but not miſcible with Oil. The berries dried whilſt green, and macerated in Alum-water, are ſaid to yield a yellow pigment; and when they have grown over-ripe, ſo as to fall off

ſpontan.

ſpontaneouſly, a purple one. Woolen cloth, prepared with Alum and Tartar, receives, on being boiled with the berries, a periſhable yellow dye. The French berries, or *Graine d'Avignon* of the French dyers, one of the moſt falſe, that is the moſt periſhable, of the yellow dyes, is the berry of a ſpecies of Buckthorn, ſmaller than that which grows wild among us.

It is ſaid that the berry of the *Helictropium tricoccum*, which grows wild about Montpelier, ſtains paper of a green colour, and that this green turns preſently to a blue: That the common blue paper receives its colour from this juice: And that the red rags called *Turnſol*, employed for colouring Wines and other liquors, are tinctured by the ſame juice turned red by acids. According to M. Niſſole of the French academy of ſciences, (as quoted by Savary in his *Dictionnaire de commerce*,) the colouring juice is obtained, not from the berries, but from the tops of the plant, gathered in Auguſt, ground in mills, and then committed to the preſs. The juice is expoſed to the ſun about an hour, the rags dipt in it, dried in the ſun, moiſtened by the vapour which ariſes during the ſlaking of Quick-lime with Urine, then dried again in the ſun, and dipt again in the juice. The Dutch and others are ſaid to prepare turnſol rags, and turnſol in the maſs, from different ingredients, among which Archil is a principal one.

In ſome plants, Peony for inſtance, the ſeeds, at a certain point of maturity, are covered with a fine ſhining red membrane: The Pellicles of the ſeeds of a certain American tree afford the red maſſes brought into Europe under the names of Annotto, Orlean, and Roucou. The red ſeeds, cleared from the pods, are ſteeped in Water for ſeven or eight days or longer, till the liquor begins to ferment; then ſtrongly ſtirred, and ſtamped with wooden paddles and beaters, to promote the ſeparation of the red ſkins: This proceſs is repeated ſeveral times till the ſeeds are left white. The liquor, paſſed through cloſe cane ſieves, is pretty thick, of a deep red colour, and a very ill ſmell: In boiling, it throws up its colouring matter to the ſurface in form of ſcum, which is afterwards boiled down by itſelf to a due conſiſtence, and made up while ſoft into balls.

The Annotto, commonly met with among us, is moderately hard and dry, of a brown colour on the outſide, and a dull red within. It is difficultly acted upon by Water, and tinges the liquor only of a pale browniſh yellow colour. In rectified Spirit of Wine, it very readily diſſolves, and communicates a high orange or yellowiſh red. Hence it is uſed as an ingredient in varniſhes, for giving more or leſs of an orange caſt to the ſimple yellows. Alcaline Salts render it perfectly ſoluble in boiling Water, without altering its colour: Wool or Silk, boiled in the ſolution, acquire a deep but not a very durable, orange dye. Its colour is not changed by Alum or by acids, any more than by alcalies; but when imbibed in cloth, it is diſcharged by Sope, and deſtroyed by expoſure to the air.

Mr. Pott, in the Berlin Memoirs for the year 1752, mentions a very extraordinary property of this concrete: "With the vitriolic acid, it "produces a *blue* colour, of extreme beauty, but with this capital defect, "that all Salts and Liquors, even common Water deſtroy it." The ſpecimen of Annotto which I examined was not ſenſibly acted upon by Spirit of Vitriol: It received no change in its own colour, and communicated none to the liquor. Nor did any viſible change enſue, upon dropping the acid into tinctures of Annotto made in Water or in Spirit.

Labat informs us, that the Indians prepare an Annotto greatly ſuperior to that which is brought to us; of a bright ſhining red colour, almoſt equal to carmine: That for this purpoſe, inſtead of ſteeping and fermentmenting the ſeeds in Water, they rub them with the hands, previouſly dipt in Oil, till the pellicles come off and are reduced into a clear paſte, which is ſcraped off from the hands with a knife, and laid on a clean leaf, in the ſhade to dry. De Laet, in his notes on Marcgrave's natural hiſtory of Brazil, mentions alſo two kinds of Annotto; one of a permanent crimſon colour, (*Coccineus*) uſed as a fucus; and another which gives a colour inclining more to that of Saffron. This laſt, which is our Annotto, he ſuppoſes to be a mixture of the firſt ſort with certain reſinous matters, and with the juice of the root of the tree——Ximenes relates, that Annotto with urine ſtains linen of ſuch a permanent colour, that it is never to be waſhed out. Perhaps the firſt ſort is meant. Our Annotto, boiled in urine, imparted to linen a deep yellowiſh red: The ſtained linen, hung out in the air in ſummer, in ſeven or eight days loſt all its colour and became white again.

LEAVES.

THE green colour of the leaves of plants is extracted by rectified Spirit of Wine and by Oils. The ſpirituous tinctures are generally of a fine deep green, even when the leaves themſelves are dull coloured, or yellowiſh, or hoary. The colour, however, ſeldom abides long even in the liquor; much leſs when the tinging matter is ſeparated in a ſolid form, and expoſed with a large ſurface to the air. The editor of the Wirtemberg Pharmacopœia, obſerves, that the leaves of *Acanthus*, Brankurſine or Bears-breech, give a more durable green tincture to Spirit than thoſe of any other herb. Alcalies heighten the colour both of the tinctures and green juices: Acids weaken, deſtroy, or change it to a browniſh: Lime-water improves both the colour and durability: By means of Lime, not inelegant, green lakes are procurable from the leaves of Acanthus, Lily of the valley, and ſeveral other plants.

There are very few herbs which communicate any ſhare of their green colour to Water: perhaps none that give a green of any conſiderable deepneſs. It is ſaid, however, that the leaves of ſome plants give a green dye to woollen, without the addition of any other colouring matter; particularly thoſe of the wild Chervil or Cow-weed, (*Myrrhis ſylveſtris ſeminibus lævibus C. B.*) the common Ragwort, and Devils-bit. The proceſs with this laſt as deſcribed by Linnæus (in the *Svenſka acad. handl. års*, 1742.) is pretty remarkable. The peaſants, he informs us, in ſome of the Swediſh provinces, ſtratify the freſh leaves with woollen yarn, and boil them about as long as it is cuſtomary to boil fiſh. The whole is ſuffered to ſtand in the veſſel for a night: The wool, taken out in the morning, does not appear to have received any colour. The pot is again made hot, and the yarn hung over it, upon a ſtick, covered with an inverted diſh to confine the ſteam, for this *ſteam* is ſuppoſed to be eſſential to the colour. The yarn is afterwards wrung, the leaves taken out of the boiling liquor, a little freſh Water added to the decoction, and the wool frequently dipt therein, till it appears ſufficiently coloured.

The leaves of many kinds of herbs and trees give a yellow dye, to wool or woollen cloth that has been previouſly boiled with a ſolution of Alum and Tartar: Weld in particular affords a fine yellow, and is commonly made uſe of for this purpoſe by the dyers, and cultivated in large quantity in ſome parts of England. There is no colour for which we have ſuch plenty of materials as for yellow. Mr. Hellot obſerves in his *Art de teindre*, that all leaves, barks, and roots, which on being chewed diſcover a ſlight aſtringency, as the leaves of the Almond, Peach and Pear-trees, Aſh-bark, (eſpecially that taken off after the firſt riſing of the ſap in ſpring) the roots of wild Patience, &c. yield durable yellows, more or leſs beautiful according to the length of time that the boiling is continued, and the proportions of Alum and Tartar in the preparatory liquor: That a large quantity of Alum makes theſe yellows approach to the elegant yellow of Weld: That if the Tartar is made to prevail, it inclines then to an orange: That if the roots, barks or leaves be too long boiled, the yellow proves tarniſhed, and acquires ſhades of brown: That for dying with Weld, the beſt proportions of the Salts are, four parts of Alum, and one of Tartar, to ſixteen of the wool; and that the wool, prepared with theſe is to be boiled again with five or ſix times its quantity of Weld: That for light ſhades, it is cuſtomary to diminiſh the Alum, and omit the Tartar; and that in this caſe the colour is more ſlowly imbibed, and proves leſs durable.

Of all the colours of the dyer, we have the feweſt materials for blue. The mineral and animal kingdoms afford none; excepting perhaps Pruſſian blue, which Mr. Macquer has lately attempted to introduce into this art. The vegetable yields but two, which are both produced from the leaves of plants, indigo and woad.

INDIGO.

INDIGO, one of the capital manufactures of America, is prepared from a ſmall, fleſhy, ſoft leaf, of a greeniſh brown colour on the upper-ſide, pale and as it were ſilver-coloured underneath. The plant, called *Anil* or *Nil*, has ſeveral ſlender knotty ſtalks, which ſpread into ſmall branches, clothed each with from four to ten pair of theſe leaves and an odd one at the end: It riſes to the height of about two feet, and produces reddiſh flowers, in ſhape reſembling thoſe of broom, but ſmaller, followed by oblong pods, containing the ſeeds.

Labat has given a particular account of the culture of the plant, and the preparation of the Indigo—The ground being thoroughly cleared from weeds (one of the principal points in the culture) a number of ſlaves, ranged in a line, march acroſs, making little trenches of the width of their hoes and two or three inches deep, about a foot diſtant from one another every way: Then, returning, they drop ſome ſeeds in each trench, and afterwards cover them with the earth taken out. In moiſt weather, the plant comes up in three or four days; and in about two months after, is fit for cutting: If ſuffered to ſtand till it runs into flower, the leaves become too dry and hard, and the Indigo obtained from them proves leſs in quantity, and leſs beautiful: The due point of maturity is known, by the leaves beginning to grow leſs ſupple, or more brittle. In rainy ſeaſons, the cutting may be repeated every ſix weeks: Cutting in dry weather kills the plant, which, if that is avoided, continues to afford freſh crops for two years.

A large quantity of the herb is put into a vat or ciſtern of ſtrong maſon-work, with ſo much Water, as is ſufficient to cover it; and ſome wood laid above, to prevent its riſing up. The matter begins to ferment, ſooner or later according to the warmth of the weather and the maturity of the plant, ſometimes in ſix or eight hours, and ſometimes not in leſs than twenty. The liquor grows hot, throws up a plentiful froth, thickens by degrees, and acquires a blue colour inclining to violet. At this time, without touching the herb, the liquor impregnated with its tincture is let out, by cocks in the bottom, into another vat placed for that purpoſe ſo as to be commanded by the firſt.

In the ſecond vat, the liquor is ſtrongly and inceſſantly beat and agitated, with a kind of buckets fixed to poles, till the colouring matter is united into a body. A good deal of nicety is requiſite in hitting this point: If the beating is ceaſed too ſoon, a part of the tinging matter remains diſſolved in the liquor; if continued a little too long, a part of

that

INDIGO.

that which had ſeparated is diſſolved afreſh. The exact time for diſcontinuing the proceſs is determined, by taking up ſome of the liquor occaſionally in a little cup, and obſerving whether the blue fecula is diſpoſed to ſeparate and ſubſide.

The whole being now ſuffered to reſt till the blue matter has ſettled, the clear Water is let off, by cocks in the ſides at different heights; and the blue part diſcharged by a cock in the bottom, into another vat. Here it is ſuffered to ſettle for ſome time longer, then further drained in cloth bags, and expoſed in ſhallow wooden boxes to the air till thoroughly dry.

The author above-mentioned, from whom the whole of the foregoing account is extracted, obſerves further, that the goodneſs of the Indigo depends greatly upon the age of the plant; that before it has grown fully ripe, the quantity it yields is leſs, but the colour proportionably more beautiful; that probably the ſecret of thoſe, whoſe Indigo has been moſt eſteemed, is no other than cutting the herb at the time when it yields the fineſt colour; that the ſuperiority of ſome of the Indigoes of the Eaſt-Indies to thoſe of America, is perhaps owing to the former being prepared more curiouſly from only the leaves of the plant; and that by beating the herb in the ſteeping-vat, which has been practiſed by ſome with a view to increaſe the quantity, great part of the ſubſtance of the leaves and bark is blended with the Water along with the colouring matter, and the Indigo extremely debaſed.

It is ſaid that Lime or Lime-water is ſometimes employed in the beating vat, to promote the ſeparation of the tinging particles from the Water; and that the hardneſs or flintineſs of ſome ſorts of Indigo is owing to an over proportion of this addition.

Indigo is commonly divided, from the colour which it exhibits upon breaking, into three kinds, copper-coloured, purple, and blue: It is ſaid that the dyers uſe chiefly the firſt; and the calico-printers (for this drug gives a durable ſtain to linen as well as woollen) the laſt. On what particular circumſtances theſe different appearances depend, we know not; nor is it certainly known, whether the real quality of the Indigo has any connexion with them. The deepeſt and livelieſt blue Indigo, rubbed with the nail, looks like poliſhed Copper; and ſolutions of all the ſorts, made in alcaline lixivia, aſſume alike a copper-coloured ſkin upon the ſurface.

Good Indigo is moderately light, breaks of a ſhining ſurface, and burns almoſt wholly away upon a red hot iron. It is quickly penetrated by Water, and reduced into a kind of paſte: A conſiderable part is at the ſame time diffuſed through the liquor, and very ſlowly ſubſides: This is probably what Labat and Hellot mean by its diſſolving in Water, for no part of the Indigo really diſſolves; it cannot indeed be expected that it ſhould, from the proceſs by which it is obtained.

Indigo requires an equal quantity or more of fixed alcaline Salt, to render it totally ſoluble in Water. On digeſting the Indigo, with a gentle heat, in the ſolution of the alcaline Salt, a ſhining copper-coloured ſkin begins to appear, and gradually covers the whole ſurface: On agitating the matter, a large blue flower or froth ariſes, and the liquor underneath appears of a deep green. If woollen cloth, without any other preparation than moiſtening it with warm Water, be dipt in this hot liquor, it comes out perfectly green, and changes almoſt inſtantly in the air to a fine blue. This is the common proceſs of dying blue.

Mr Hellot deſcribes two Indigo vats with urine; one of which is uſed hot like the foregoing, and the other cold. The hot vat conſiſts of equal parts of Indigo, Alum and Tartar, digeſted in urine till the liquor becomes green. The cold one is prepared, by digeſting powdered Indigo with

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Vinegar for twenty-four hours, in the proportion of four pounds to about three quarts; then mixing the matter with about fifty gallons of urine, and ſtirring the whole together every night and morning, till the liquor turns green, and gathers a head like the common vat.

Indigo is fitted for printing on linen, by diluting it with Water into the conſiſtence of a ſyrup; then adding ſome powdered Pearl-aſhes, green Vitriol, and Lime newly ſlaked; with ſo much Water, occaſionally, as will reduce them into the conſiſtence of thin paint; mixing the whole thoroughly together, and ſtirring the matter every now and then, till it gains a copper colour on the ſurface. The proportions uſed by the workmen are two parts of Indigo, one of Pearl-aſhes, three of Vitriol, and two of Lime.

The ſame compoſition, diluted with a ſufficient quantity of Water (about ſix gallons to a pound of Indigo) and boiled, gives a durable blue to tanned ſkins, whether dipt in it hot or cold.

Indigo, digeſted in a moderate heat with different volatile alcaline ſpirits, gave only yellowiſh and browniſh red tinctures; with rectified Spirit of Wine, a reddiſh one: To Lime-water, and to Water acidulated with the vitriolic, nitrous and marine acids, it gave no tincture at all.

The concentrated vitriolic acid unites with it into a ſmooth paſte, eſpecially if the Indigo is previouſly well ground with powdered glaſs, ſand, or other like ſubſtances: The Indigo is thus rendered ſoluble in boiling Water along with the acid, ſo as to paſs through the pores of a filter: The ſolution, whilſt hot, appears of a deep bright green colour, like that made by fixed alcalies, but fades as it grows cold, and changes at laſt to a browniſh.

Theſe experiments, which were many times repeated with the ſame event, ſeem to overturn Mr. Hellot's ingenious theory; which deduces the green colour of ſolutions of Indigo from the common property of blue juices of being turned green by alcalies; and the blue colour which the cloth acquires ſoon after it is taken out of the vat, from a ſeparation of the alcali. We here find, that a green ſolution of this concrete is obtainable by the ſtrongeſt of the acids, and that with volatile alcalies it diſcovers no tendency to greenneſs.

The ſolution of Indigo in Oil of Vitriol does not appear green till diluted. The thick compound dropt into Water no hotter than the hand can bear, communicates a bright blue colour: Woollen cloth or ſilk, prepared with Alum and Tartar, acquire from this liquor the beautiful but periſhable blue dye, called Saxon Blue. The Saxon green is dyed, by dipping the ſtuff a ſecond time in the yellow decoction of Fuſtic; or more compendiouſly, by mixing the acid blue compoſition with that decoction at once, till the liquor has gained the depth of colour required.

I have been informed that the dyers of Norwich, who purchaſed this ſecret from Saxony, prepare the blue compoſition by grinding nine parts of Indigo with twenty of red Arſenic; then adding to them in a glazed veſſel, forty-eight parts of Oil of Vitriol, and ſtirring them well together: After the mixture has ſtood for twenty-four hours, it is fit for uſe. In Mr. Hellot's proceſs, received likewiſe from Germany, the proportions are ſomewhat different; and inſtead of red Arſenic, Cobalt and Orpiment are uſed. Theſe differences are immaterial: the only uſe of the additional matter ſeems to be, to divide the Indigo, and render it more eaſily miſcible with the acid. I have ſucceeded, in ſmall ſpecimens with red and with white Arſenic, with Orpiment and with Cobalt, with Sulphur, with Antimony, with powdered glaſs, with powdered Sand, and with Flint.

The Indigo, in the diluted blue liquors, is perfectly diſſolved, ſo as to paſs through a filter. The ſolutions, haſtily evaporated to the conſiſtence of a Syrup, become turbid and green. On ſlow evaporation, they

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continued uniform and blue, and readily mingled again with freſh water; paſſing the filter as before of a fine blue colour.

WOAD.

WOAD, *Iſatis*, *Glaſtum*, is a plant with long green leaves; the lower ones narrow at both ends; thoſe which grow upon the ſtalk broad at bottom like an arrow head. On the tops come forth numerous yellow flowers, which are followed by little flat pods containing the ſeeds. It grows wild in ſome parts of France, and on the coaſts of the Baltic ſea: The wild Woad, and that which is cultivated for the uſe of the dyers, appear to be the ſame ſpecies of plant.

The preparation of Woad for dying, as practiſed in France, is minutely deſcribed by Aſtruc, in his memoirs for a Natural Hiſtory of Languedoc——The plant puts forth at firſt five or ſix upright leaves, about a foot long and ſix inches broad: When theſe hang downwards, and turn yellow, they are fit for gathering: Five crops are gathered in one year. The leaves are carried directly to a mill, much reſembling the oil or tan-mills, and ground into a ſmooth paſte. If this proceſs was deferred for ſome time, they would putrefy, and ſend forth an inſupportable ſtench. The paſte is laid in heaps, preſſed cloſe and ſmooth, and the blackiſh cruſt, which forms on the outſide, reunited if it happens to crack: If this was neglected, little worms would be produced in the cracks, and the Woad would loſe of its ſtrength. After lying for fifteen days, the heaps are opened, the cruſt rubbed and mixed with the inſide, the matter formed into oval balls, which are preſſed cloſe and ſolid in wooden moulds. Theſe are dried upon hurdles: In the ſun, they turn black on the outſide; in a cloſe place, yellowiſh, eſpecially if the weather is rainy: The dealers in this commodity prefer the firſt, though it is ſaid the workmen find no conſiderable difference betwixt the two. The good balls are diſtinguiſhed by their being weighty, of a pretty agreeable ſmell, and when rubbed, of a violet colour within—For the uſe of the dyer, theſe balls require a further preparation: They are beat with wooden mallets, on a brick or ſtone floor, into a groſs powder; which is heaped up in the middle of the room to the height of four feet, a ſpace being left for paſſing round the ſides. The powder, moiſtened with water, ferments, grows hot, and throws out a thick fetid fume. It is ſhovelled backwards and forwards, and moiſtened every day for twelve days; after which, it is ſtirred leſs frequently, without watering, and at length made into a heap for the dyer.

The powder thus prepared, gives only browniſh tinctures, of different ſhades, to water, to rectified Spirit of Wine, to volatile alcaline ſpirits, and to fixed alcaline Lixivia: Rubbed on paper, it communicates a green ſtain. On diluting the powder with boiling water, and after ſtanding for ſome hours in a cloſe veſſel, adding about one twentieth its weight of Lime newly ſlaked, digeſting in a gentle warmth, and ſtirring the whole together every three or four hours, a new fermentation begins, a blue froth ariſes to the ſurface, and the liquor, though it appears itſelf of a reddiſh colour, dyes woollen of a green, which, like the green from Indigo, changes in the air to a blue. This is one of the niceſt proceſſes in the art of dying, and does not well ſucceed in the way of a ſmall experiment.

Aſtruc propoſes the manufacturing of freſh Woad leaves in Europe, after the ſame manner, as the Indigo plant is manufactured in America; and thus preparing from it a blue fecula ſimilar to Indigo, which from his own experiments he has found to be practicable. Such a management would doubtleſs be accompanied with ſome advantages, though poſſibly, Woad ſo prepared might loſe thoſe qualities, which now render it, in a large buſineſs, preferable on ſome accounts to Indigo, as occaſioning greater diſpatch when once the vat is ready, and giving out its colour leſs haſtily, ſo as to be better fitted for dying very light ſhades.

Hellot ſuſpects that a like blue fecula is procurable from many other vegetables. Blue and yellow blended together, compoſe a green : He ſuppoſes the natural greens of vegetables to be compounded in like manner of thoſe two colours ; and that the blue is oftentimes the moſt permanent, ſo as to remain entire after the putrefaction or deſtruction of the yellow. The theory is ſpecious, and perhaps juſt : We know of no other that accounts, in any degree, for the production of the Indigo and Woad blue. In the experiments, however, which I have made, of putrefying different herbs in water, the blue and the yellow colour, if the green was really compoſed of theſe, were both deſtroyed together, no appearance being obſerved, either of one or the other during the whole proceſs.

MOSSES.

THERE are ſundry Moſſes, which in their natural ſtate, like the two foregoing plants, promiſe nothing of the elegant colours, which art calls forth from them.

Archil, *Archilla, Rocella, Orſeille*, a whitiſh Moſs growing upon rocks in the Canary and Cape Verd iſlands, yields a rich purple tincture, fugitive indeed, but extremely beautiful. This weed is imported to us as it is gathered : Thoſe who prepare it for the uſe of the dyer, grind it betwixt ſtones, ſo as to thoroughly bruiſe but not to reduce it into powder, and then moiſten it occaſionally with a ſtrong Spirit of Urine, or Urine itſelf mixed with Quick-lime : In a few days it acquires a purpliſh red, and at length a blue colour : In the firſt ſtate it is called Archil, in the latter Lacmus or Litmaſe.

The dyers rarely employ this drug by itſelf, on account of its dearneſs and the periſhableneſs of its beauty. The chief uſe they make of it is, for giving a bloom to other colours, as pinks, *&c.* This is effected by paſſing the dyed Cloth or Silk through hot water lightly impregnated with the Archil. The bloom thus communicated ſoon decays upon expoſure to the air. Mr. Hellot informs us, that by the addition of a little ſolution of Tin, this drug gives a durable dye ; that its colour is at the ſame time changed towards a ſcarlet : and that it is the more permanent, in proportion as it recedes the more from its natural colour.

Prepared Archil very readily gives out its colour to water, to volatile ſpirits, and to Spirit of Wine : It is the ſubſtance principally made uſe of for colouring the ſpirits of thermometers. As expoſure to the air deſtroys its colour upon cloth, the excluſion of the air produces a like effect in theſe hermetically ſealed tubes ; the ſpirits of large thermometers becoming in the compaſs of a few years colourleſs. M. l'Abbè Nollet obſerves,(in the French Memoirs for the year 1742) that the colourleſs ſpirit, upon breaking the tube, ſoon reſumes its colour, and this for a number of times ſucceſſively ; that a watery tincture of Archil, included in the tubes or thermometers, loſt its colour in three days ; and that in an open deep veſſel, it became colourleſs at the bottom, while the upper part retained its colour.

A ſolution of Archil, in water, applied on cold marble, ſtains it of a beautiful violet, or purpliſh blue colour, far more durable than the colour which it communicates to other bodies. Mr. du Fay ſays he has ſeen pieces of marble ſtained with it, which in two years had ſuffered no ſenſible

MOSSES.

change. It ſinks deep into the Marble, ſometimes above an inch; and at the ſame time ſpreads upon the ſurface, unleſs the edges be bounded by Wax or other like ſubſtances. It ſeems to make the marble ſomewhat more brittle.

Linnæus informs us, in the Swediſh Tranſactions for the year 1742, that the true Archil Moſs is to be found on the weſtern coaſts of England; and ſuſpects, that there are ſeveral other more common Moſſes, from which valuable colours might be extracted: A quantity of Sea-moſs having rotted in heaps upon the ſhore, he obſerved the liquor in the heaps to look like blood, the ſea-water, and the ſun, and the putrefaction having brought out the colour. Mr. Kalm, in an appendix to Linnæus's paper in the year 1745, mentions two ſorts of Moſſes actually employed in ſome parts of Sweden for dying Woollen red: One is the *Lichenoides coralliforme apicibus coccineis* of Ray's Synopſis; the other, the *Lichneoides tartareum; farinaceum, ſcutellarum umbone fuſco* of Dillenius. This laſt is a white ſubſtance, like meal clotted together, found on the ſides and tops of hills. It is ſhaved off from the rocks after rain, purified from the ſtony matters intermixed among it by waſhing with water, then dried in the ſun, ground in mills, and again waſhed and dried: It is then put into a veſſel with Urine, and ſet by for a month: A little of this tincture added to boiling water makes the dying liquor.— In the ſame Tranſactions, for the year 1754, there is an account of another Moſs, which prepared with Urine, gives a beautiful and durable red or violet dye to Wool and Silk. This is the *Lichen foliaceus, umbilicatus ſubtus lacunoſus Linn. flor. ſuec.* It grows upon rocks, and is readily diſtinguiſhed from others of that claſs, by its looking as if burnt or parched, conſiſting of leaves as thin as paper, convex all over on the upper ſide, with correſponding cavities underneath, adhering firmly to the ſtones by a litttle root under the leaves, and coming aſunder, when dry, as ſoon as touched. It is gathered after rain, as it then holds beſt together, and parts eaſieſt from the ſtone.

In France, a cruſtaceous Moſs, growing upon rocks in Auvergne, is prepared with Lime and Urine, and employed by the dyers as a ſuccedaneum to the Canary Archil, to which it is ſaid to be very little inferior: It is called *Orſeille d'Auvergne* or *Perelle*. Mr. Hellot relates, that he has met with ſeveral other Moſſes, which on being prepared in the ſame manner, acquire the ſame colour. The moſt expeditious way, he ſays, of trying whether any Moſs will yield an Archil or not, is, to moiſten a little of it with a mixture of equal parts of Spirit of Sal Ammoniac and ſtrong Lime-water, and add a ſmall proportion of crude Sal ammoniac: The glaſs is then to be tied over with a piece of bladder, and ſet by for three or four days. If the Moſs is of the proper kind, the little liquor which runs from it upon inclining the veſſel, will appear of a deep crimſon colour; and this afterwards evaporating, the plant itſelf acquires the ſame colour.

I have tried a good number of the common Moſſes, both of the cruſtaceous and foliaceous kind, and not a few of the fungi; as alſo the herbs Camomile and Milfoil, which yield a blue eſſential Oil, and Thyme whoſe Oil becomes blue by digeſtion with volatile ſpirits; but have not as yet met with any that yielded a colour like Archil. Moſt of them gave a yellow or reddiſh-brown tincture; and if there was a ſcarcity of other drugs for theſe kinds of dyes, ſome of the Moſſes might be made to afford not inelegant ones. A few gave a deep red colour to the liquor; but when diluted it ſhewed a yellowiſh caſt, and when applied on cloth it gave only a yellowiſh red.

SECTION IV.

Artificial productions from VEGETABLES.

ARTIFICIAL PRODUCTS.

IN the foregoing ſections we have endeavoured to inveſtigate the internal conſtitution of vegetables in their natural ſtate by operations which do not alter their qualities; to diſcover, extract, and preſerve thoſe principles which actually exiſt in them, and in which their ſpecific powers reſide. It has formerly been obſerved, that theſe principles are far from being elementary bodies. By fermentation, and by the force of fire, the Gums, the Reſins, the Oils, and the Salts of vegetables, are reſolved or converted into more ſimple parts, and ſome of theſe combined variouſly together again into new compounds: The taſte, the ſmell, the colour of the original vegetable are deſtroyed, and ſubſtances of entirely different qualities are produced.

CLASS I.

Products from Vegetables by Fermentation.

FERMENTATION.

Vinous.

SWEET vegetable juices or infuſions made in water, however bright pellucid and apparently homogene, on being kept in a temperately warm place in veſſels not cloſely ſtopt, become turbid, conceive an inteſtine motion, emit numerous air bubbles, and diſcharge a pungent vapour of extreme ſubtility and activity, inſomuch as, when confined and accumulated in cloſe rooms, to extinguiſh fire and ſuffocate animals: Its producing the firſt of theſe effects, is a mark that it is collected in ſufficient quantity to produce the other: When candles continue to burn, we need not be afraid that this wild Gas, as Helmont calls it, will be dangerous to life. As the fermentation advances, a large quantity of groſs, unctuous, ſaline and earthy matter is ſeparated and thrown off,

partly

partly to the ſurface, and partly to the bottom of the veſſel: The liquor loſes its ſweet taſte and acquires a vinous one, and on being now committed to diſtillation yields, not as at firſt a mere watery phlegm, but an inflammable inebriating ſpirit——— Acetous. On continuing the fermentation beyond the ſtate of vinoſity, more matter is thrown off, new combinations take place, the inflammable ſpirit is deſtroyed, and the liquor becomes ſour—— Putrefactive. If the proceſs be ſtill further protracted, the acid ſtate is ſucceeded by a putrefactive one; during which a volatile alcaline Salt is both generated and diſſipated: The ſolid matter that now remains is an earth ſimilar to common mould; and if any fluid is left, it is found to be an inſipid water.

Obſervations on its three ſtages. Fermentation is hence divided, according to its effect, into three ſtages or degrees, vinous, acetous, and putrefactive: The product of the firſt is an inflammable ſpirit, and of the ſecond an acid, both of which are peculiar to the vegetable kingdom: The volatile alcali, produced by the third ſtage, is ſimilar to that obtained, more plentifully, from animal ſubſtances by the action of fire without putrefaction. The putrefactive ſtage always follows the vinous and acetous, unleſs prevented by art, but it is not always preceded by them, all vegetables being ſuſceptible of putrefaction, whilſt thoſe only that have a manifeſt ſweetneſs are capable of yielding a vinous liquor. The ſweeter and richer the vegetable juice, the longer does the vinous fermentation continue, and the ſtronger and more ſpirituous is the Wine: The more acid alſo is the Vinegar.

Impeded and promoted. It is obſervable that when ſweet juices are boiled down to a thick coſiſtence, they not only do not ferment in that ſtate, but are not eaſily brought into fermentation when diluted with as much water as they had loſt in the evaporation, or even with the very individual water that had exhaled from them. Juices and decoctions in general, that have ſuffered much fire, however ſweet, are little diſpoſed to ferment. Hence ſundry ſweet liquors, naturally very propenſe to run into this proceſs, and to run haſtily through all its ſtages, are preſerved for a length of time by being boiled.

FERMENTATION.

The head which forms on the ſurface of fermenting liquors greatly haſtens the fermentation of others, and determines them to the ſame ſpecies of fermentation with that of the liquor from which the ferment was taken. The grand promoters of all the ſtages of this proceſs are, warmth, a moderate admiſſion of air, and the addition of matters in an actually fermentative ſtate. When the vinous ſtage is completed, the acetous would ſoon begin, if the liquor was not racked into freſh veſſels, ſecured from the air, and kept in a cold place.

I. WINES.

WINES.

THE juices of ſweet fruits in general, Currants, Mulberries, Raſpberries, Apples, Pears, *&c.* are called, when fermented, Wines; but the name is more peculiarly applied to the fermented juice of the Grape or the fruit of the Vine-tree.

There is a great variety of Grapes, colourleſs, yellowiſh, bluiſh, and red; more or leſs ſweet, and of more or leſs flavour. The colour is lodged not in the juice but in the ſkin of the Grape: The juice however, as a menſtruum, frequently extracts and becomes impregnated with it during its expreſſion from the fruit.

Differences in Grapes from climate, *&c.*

One and the ſame kind of Grape proves greatly different in taſte and flavour, according to the climate and expoſure to the ſun. In cold countries the Vine, if it grows at all, never ripens its fruit; and even in France and Italy I have obſerved, that the Grapes produced on the South-ſides of hills are notably ſweeter than thoſe which grow on plane grounds. Among the Tockay Wine-hills, there is but one which directly fronts the South, and the advantages of its ſituation are not a little remarkable: From the extraordinary ſweetneſs of its Grapes, it is called the Sugar-hill. It affords the moſt delicious of all the Hungarian Wines, and is appropriated to the uſe of the imperial family.

In very warm dry ſeaſons, the Grapes at the bottoms of the hills are beſt; in warm and moiſt ones, thoſe at the top,; ſuch as grow in the middle region being always good. In dry ſummers, the Grapes are ſweeteſt, but leaſt juicy: In rainy ones they abound with juice, which proves proportionably weaker and more dilute. Froſts in autumn promote their ripening; but froſt ſucceeding heavy rains make them apt to burſt and ſhed their juice.

In ſome places, the Grape is concentrated or rendered richer, by ſuffering it to remain on the tree till great part of its watery moiſture has exhaled, the ſtem of each cluſter being cut half through, when the fruit is ripe to prevent the afflux of any freſh juice from the plant. The ſweet Hungarian and Spaniſh Wines are made from Grapes that have thus been half dried. The Raiſins, and Currants of the ſhops, are different ſpecies of Grapes, dried either in this manner, or by the ſolar or culinary heat after gathering.

Muſt, its differences; The juice of the Grape is called, before its fermentation, Muſt. Different ſorts of Muſt are obtained from the ſame kind of Grape, produced in the ſame vineyard, according to the method of management. The beſt is that which iſſues upon breaking, bruiſing, or treading the picked fruit: Inferior ſorts are extracted by forcibly preſſing the entire cluſter, ſtalks and all. **Enriched.** Dilute watery Muſts are enriched by infuſing in them dried Grapes, or by inſpiſſating a part of the liquor and adding this to the reſt. By theſe means ſtrong full-bodied Wines are obtainable from the pooreſt juices; and by ſimilar managements even the better ſorts of Grape-wines are imitable with the juices of other fruits, artificially concentrated, or heightened with the ſimple ſweetneſs of Sugar.

Arrangement of Wines according to their production. Wine may be divided, with reſpect to the fermentation, into three claſſes. (1.) Thoſe of the firſt do not indeed deſerve the name of Wines, as having ſcarcely ſuffered any degree of fermentation at all, and being no other than boiled Muſt. Several of the Italian Wines are of this ſort, and are called by the general name of *Vino cotto* or boiled Wine. It is to thin watery juices, extremely prone to ferment, and in which fermentation, when once begun, can ſcarcely be ſuppreſſed till it has run beyond the vinous ſtate, that this proceſs is applied: By boiling, the fermentative quality is reſtrained, and the liquor becomes richer and continues fit for drinking for at leaſt a year or two, though it is never ſo wholeſome as the fermented Wines. The effects of Muſt and Wine upon animal bodies are diametrically different: Muſt relaxes and liquefies, and if drank immoderately, is apt to produce dangerous fluxes: Perfect Wine, on the contrary, corroborates and conſtringes. (2.) The ſecond claſs comprehends thoſe Wines, which have undergone fermentation, but not a complete one: Of theſe there are two kinds. The firſt is the thin ſweet Wines; which are no other than Muſt partially fermented, or whoſe fermentation is checked, while it can be checked, before the ſweetneſs has gone off: Theſe Wines can ſcarcely be kept above a year: Such are the Tyrol, ſome of the Savoy, and ſeveral of the Italian. The ſecond ſort is the ſtrong, full-bodied, rich, ſweet Wines, which are generally a mixture of fermented and inſpiſſated Muſt; the latter being added to increaſe the richneſs of the liquor, and prevent the fermentation from running beyond its due limits: Theſe kinds of Wines greatly heat the conſtitution, and ought to be very ſparingly drank: Such as Malmſey, Canary, and ſome of the Spaniſh and Hungarian Wines. (3.) To the third claſs belong thoſe Wines which have been completely fermented, and have thrown off their groſs matter. Theſe are the moſt perfect Wines, and for common uſe the moſt wholeſome.

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The principal Wines drank in Europe are as follows. (1.) The Madera iſlands, and Palma one of the Canaries, afford two kinds; the firſt call'd Madera Sec; the latter, which is the richeſt and beſt of the two, Canary or Palm Sec. The name *Sec* (corruptly written *Sack*,) ſignifies *dry*; theſe Wines being made from half dried Grapes. There is another ſort of Sec Wine, inferior to both the foregoing, prepared about Xeres in Spain, and hence called, according to our orthography, Sherris or Sherry. (2.) The Wines of

Account of the principal Wines of Europe.

WINES. Candia and Greece, particularly the latter, are of common uſe in Italy. Malmſey was formerly the produce of thoſe parts only, but is now brought chiefly from Spain: It is a ſweet Wine, of a golden or browniſh-yellow colour: The Italians call it *Manna alla bocca e balſamo al cervello,* “ Manna to the mouth and balſam to the brain.” Zant and Cephalonia ſend alſo to Venice ſome good, and no ſmall quantity of indifferent Wines: Almoſt all the Wines indeed made uſe of in the Venetian territories come from Greece and the Morea; of which there are ſome ſorts ſo bad, and ſo cheap, that large quantities are made into Vinegar for the preparation of Ceruſſe. (3.) Italy, not Greece, produces the *Vino Greco:* This is a gold-coloured unctuous Wine, of a pungent ſweetneſs, the growth of Mount Veſuvius, greatly ſophiſticated by the Neapolitans. In the neighbourhood of Veſuvius is made the *Mangiaguerra* Wine, as alſo a thick blackiſh one called *Verracia*; and at the foot of the hill the delicious *Vino vergine:* The Italians apply this laſt name likewiſe to all the other Wines made without preſſure. The kingdom of Naples affords the *Campania* or *Pauſilippo* and *Muſcatel*, the *Surrentine*, *Salernitan*, and other excellent Wines, as alſo the *Chiarello*, much drank at Rome. But the principal of all theſe Wines is the red, fat, ſweet, and gratefully poignant one, called *Lachryma Chriſti.* (4.) The eccleſiaſtical ſtate produces the light, pleaſant *Albano*; and the ſweet *Monteſiaſcone*, a yellowiſh not very ſtrong Wine, which comes the neareſt to good Florence, but does not keep well; together with ſeveral of leſs note, as the *Nomentan*, *Monteran*, *Velitrin*, *Prænetic*, *Il Romaneſca*, *d'Orvieto*, &c. (5.) In Tuſcany are the excellent white and red *Florence*; the celebrated, hot, ſtrong red Wine *de Monte Pulciano*; the *Montalneo*, *Porte Hercole*, &c. But along the coaſt of the Adriatic, at Ancona, Rimini, Peſaro, as far as Bologna, I met with exceeding bad Wines, chiefly of the boiled unfermented kind, heavy, diſagreeable, and unwholeſome. (6.) In Lombardy alſo there is abundance of bad Wines: The *Modeneſe* and *Montſerrat* are tollerable; the *Marcemino*, produced about Vicenza and Padua, pretty good.

good. The other Wines, moſt commonly drank in that province, are the *Breſcian*, *Veroneſe*, *Placentine*, *Lumelline*, and *Pucine*; and in the Genoeſe, the *Vino di monte vernaccia*, *Vino amabile* or *Vino di cinque terre* and *Vino razzeſe*. Between Nizza and Savona is produced an incomparable *Muſcadine*; near Aqueleia is the *Roſatz*, and near Pavia the *Vino piccante*. (7.) Piemont and part of Savoy have excellent light Wines. (8.) The Sicilian, Sardinian, and Corſican Wines are alſo good: The firſt, as particularly the *Catanean*, *Panormitan*, *Meſſinian*, and *Syracuſan*, are accounted the beſt, and are chiefly bought up by the Knights of Malta. (9.) Moſt of the Spaniſh Wines are compoſed of fermented or half fermented Wine mixed with inſpiſſated Muſt and variouſly manufactured, or of an infuſion of dry Grapes in weak Muſt. No Wines freeze more difficultly than the Spaniſh, theſe abounding both with unctuous matter and with inflammable ſpirit. We have a few of theſe Wines in Germany, as the *Alicant* (which is a thick, ſtrong, very ſweet, and almoſt nauſeous Wine,) *Sherry*, *Spaniſh Malmſey*, and that ſimply called *Spaniſh Wine*: But in Spain itſelf there are many more, *Tarragan*, *Salamanca*, *Malaga*, *Cordoua*, *Galicia*, *Andaluſia*, ſundry *baſtards*, *Vino de toro*, &c. (10.) In Portugal there is plenty of red *Port*, a cheap but not a very excellent Wine, drank in large quantity in England. The beſt *Vino tinto*, a blackiſh red Wine uſed by the coopers for colouring other Wines, is ſaid by ſome to be the produce of Portugal. This kingdom deals largely alſo in *Madera*, of which the King receives yearly twelve thouſand pipes by way of tithes. (11.) In France, there is a great variety of Wines; of which the ſtrong, ſweet, full-bodied, ſpirituous ones are called *Vins de liqueur*. There is ſcarcely a province in France that does not produce Wine: Languedoc and Provence afford the ſweeteſt; and the ſame provinces, with Champagne and Burgundy, the ſtrongeſt: The Wines of the Northern parts, as Picardy and Bourdeaux, are the worſt; and thoſe about the middle of the kingdom, as Paris and Orleans, of a middling kind. The moſt

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celebrated of the French Wines are, *Champagne, Burgundy, Vin de Beaune* or Partridge-eye, *Cote roti, St. Laurence, Frontiniac, Muſcat de Lion, Cabors, Hermitage, Grave, Vin d'Haye*, &c. (12.) In Switzerland, the beſt are the *Neufchatel, Velteline, Lacote* and *Reiff* Wine: The Velteline Straw-wine, ſo called from the Grapes being laid for ſome time upon ſtraw before they are preſſed, is particularly celebrated. (13.) The dry-grape Wines of the Upper Hungary are in general excellent, and greatly ſuperior to thoſe of the Lower. They have a delicious aromatic ſmell and taſte, a notably diaphoretic and corroborating virtue, and when drank freely occaſion no headach, heavineſs of the limbs, or other inconveniencies: They do not eaſily become vinewed even in open veſſels; and retain their ſweetneſs and agreeableneſs for a length of time, though they loſe a little from year to year. (14.) Among the German Wines, the *Tyrol* are very delicate, particularly thoſe of *Tramin* and *Etſch*, but they do not keep. (15.) Good Auſtrian Wine is not to be rejected. Thoſe of Kloſter-Neuburg and Broſenberg are accounted the beſt, and ſeemed to me to excel in taſte that of Edenburg in Lower Hungary. There are alſo good Wines in ſeveral other parts of the imperial dominions. (16.) In the Palatinate, the beſt Wine is that of Worms, eſpecially the ſort called Women's Milk; and next to this, thoſe of Edinghof and Ambach. (17.) Among the more eſteemed German Wines are to be reckoned alſo *Rheniſh, Mayne, Moſelle, Neckar* and *Elſaſs*: A certain writer calls the Rheniſh made in Hochheim [Hock] the Prince of the Wines of Germany. (18.) The Bohemian, Sileſian, Thuringian, Miſnian, Naumberg, Brandenburg, and other German Wines, are greatly inferior to the foregoing: Some however, of thoſe of Miſnia and the Marché, made from ripe picked Grapes, have this advantage, that they are greatly meliorated by age, ſo as to be preferred by many to the Rheniſh, Neckar and Franconia Wines, and frequently mixed with others of greater note. The tartiſh German Wines keep the longeſt

Obſervations on the keeping of Wines.

longeſt of any: Some of them have been kept for two or three hundred years; and in Straſburg there is a caſk fourteen hundred years old, and many above ſeventy; the Wine being occaſionally racked off into ſmaller and ſmaller caſks, that the veſſel may be conſtantly full. Theſe very old Wines are preſerved rather for curioſity than uſe, as they not only grow too ſtrong for drinking, but at laſt quite diſagreeable. The beſt are thoſe of a middle age, from twenty to about fifty years.

Wine ſenſibly waſtes in keeping, how cloſely ſoever the caſk is ſtopt, a part tranſpiring through the pores of the wood: It is not the ſpirituous, but the watery part that is thus loſt, for the remaining Wine proves ſtronger than at firſt, and the ſtrength continues to increaſe as the quantity diminiſhes. In filling up the veſſels, for it is neceſſary they ſhould be kept full, we muſt be careful not to mix Wines of diſſimilar qualities: The Hungarian does not well bear any other Wine, particularly Rheniſh: If the ſpontaneous diminution of a caſk of Hungarian is made up with Rheniſh, though both keep extremely well by themſelves, the mixture preſently ſpoils. Cool cellars are of primary conſequence for the preſervation of Wines: It is owing wholly to want of ſufficient defence from the warmth of the weather that Wines are ſo apt to fret or run into a new fermentation on the approach of ſummer. The ſituation of Berlin does not admit of deep cellars. I have been in ſome at Vienna three ſtories deep: The cellar of the Jeſuit's college ſeemed to be not leſs than the height of a church ſteeple under the ſtreet. It is neceſſary, for the preſervation of ſome Wines, to fumigate the caſks with burning Brimſtone, to which ſome add, perhaps uſeleſsly, vinous ſpirits and aromatic ingredients: The fumes of Brimſtone ſtrongly reſiſt fermentation, but Wines that are largely impregnated with them cannot be recommended as wholeſome: The colour of red Wines is deſtroyed by them. What is called *Stum*, is no other than

WINES. Muſt whoſe fermentation has been prevented, or prematurely ſuppreſſed, by fumigation with Sulphur.

Colouring of Wines. The colours of Wines are frequently artificial. A pale yellow may be natural, but a fine deep yellow proceeds from an addition of burnt Sugar or other colouring matters, or from the oaken caſks: Wines may be naturally of a pale dilute red, but a deep red is almoſt always the effect of artificial additions, as the red woods, Bilberries, *&c.* In France, no ſecret is made of theſe practices, the colouring matters, after they have been uſed, being publickly thrown out.

Curation, flavouring, &c. Turbid Wines are fined by a mixture of whites of eggs, powdered Alabaſter and Fiſh-glue; ſome uſe the plant *Lycopodium:* Acid ones are cured by an addition of Salt of Tartar or abſorbent earths, in ſuch quantity as to abſorb and neutralize only the redundant acid, and not that which is eſſential to the Wine, for in this caſe the liquor would ſoon become vapid: Weak Wines are improved by an addition of ſpirit, particularly before the fermentation is completed, for after this period it is apt to ſpoil the vinoſity: Poor Wines are enriched by ſweets, and flavoured by various additions ſo as to emulate the more coſtly: Thus Elder-flowers give the flavour of Moſelle: Even the more delicious Wines have been imitated alſo without a drop of the juice of any kind of Grape; with ſolutions of Sugar, juice of Currants, Figs, and other fruits.

Dangerous ſophiſtications of Wines, diſcovered. Some of the dealers in Wines have had recourſe to artifices of a more dangerous kind, which have been pernicious to thouſands: They have ſweetened acid Wines by Litharge or other preparations of Lead; and impregnated ſweet ones with Mercury-ſublimate and with Arſenic. Lead is diſcovered in Wines by adding a decoction of Orpiment made in Lime water: If the Wine is genuine, it does not ſenſibly change its colour on this addition, though on ſtanding, a yellowiſh-white powder falls to the bottom: If it has any ſaturnine impregnation, its colour becomes immediately darker, brown, reddiſh, or blackiſh. Arſenic may be detected by a ſolution of

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Lead in Aqua fortis; and Mercury-ſublimate, by volatile alcaline ſpirits, or by a ſolution of fixed alcaline Salts.

Characters of good Wine.

The goodneſs and wholeſomeneſs of Wines are judged, from their being bright, clear, and ſparkling in the glaſs; of an agreeable reviving ſmell and taſte; leaving, when in the mouth ſome time, a ſlight ſenſe of aſtringency; being moderately ſtrong and ſpirituous; paſſing freely by urine, exciting appetite; producing a gentle ſweat in the night; keeping the belly open next day; without being followed by any headach, heavineſs of the limbs, or other uneaſineſs. Such a Wine, moderately uſed, is a very valuable cordial. The ſweet rich Wines are either new, or very ſtrong and fiery: They heat the blood much more, and if drank to any degree of exceſs, their effects continue much longer than thoſe of the thinner Wines that contain an equal quantity of ſpirit. The red Wines in general have the greateſt aſtringency.

Chemical analyſis.

The principles of which Wines conſiſt are, (1) Water, the baſis of all fluids; (2) inflammable ſpirit; (3) a fine ſaline matter, which ariſes in diſtillation immediately after the ſpirit, called by Becher *Media ſubſtantia vini*; (4) A groſſer Salt called Tartar, which in part ſeparates on ſtanding and adheres to the ſides of the caſk in ſolid maſſes; (5) A gummy or mucilaginous ſubſtance, and (6) a groſs unctuous or reſinous one. The following table exhibits the quantity of the ſeveral principles in a quart of each of the Wines I have examined.

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Table of the contents of different Wines.

	Highly rectified ſpirit.			Thick, oily, unctuous, reſinous matter			Gummy and tartareous matter.			Water.			
	oz.	dr.	gr.	oz.	dr.	gr.	oz.	dr.	gr.	lb.	oz.	dr.	gr.
Aland	1	6	00	3	2	00	1	5	00	2	5	3	00
Alicant	3	6	00	6	0	20	0	1	40	2	2	6	00
Burgundy	2	2	00	0	4	00	0	1	40	2	9	0	20
Carcaſſone	2	6	00	0	4	10	0	1	20	2	8	4	30
Champagne	2	5	20	0	6	40	0	1	00	2	8	3	00
French	3	0	00	0	6	40	0	1	00	2	8	0	20
Frontignac	3	0	00	3	4	00	0	5	20	2	4	6	30
Vin Grave	2	0	00	0	6	00	0	2	00	2	9	0	00
Hermitage	2	7	00	1	2	00	0	1	40	2	7	5	20
Madera	2	3	00	3	2	00	2	0	00	2	4	3	00
Malmſey	4	0	00	4	3	00	2	3	00	2	1	2	00
Vino de Monte Pulciano	2	6	00	0	3	00	0	2	40	2	8	0	20
Moſelle	2	2	00	0	4	20	0	1	30	2	9	0	10
Muſcadine	3	0	00	2	4	00	1	0	00	2	5	4	00
Neufſchatel	3	2	00	4	0	00	1	7	00	2	2	7	00
Palm Sec	2	3	00	2	4	00	4	4	00	2	2	5	00
Pontack	2	0	00	0	5	20	0	2	00	2	9	0	40
Old Rheniſh	2	0	00	1	0	00	0	2	20	2	8	5	40
Rheniſh	2	2	00	0	3	20	0	1	34	2	9	1	06
Salamanca	3	0	00	3	4	00	2	0	00	2	3	4	00
Sherry	3	0	00	6	0	00	2	2	00	2	0	6	00
Spaniſh	1	2	00	2	4	00	9	4	00	1	10	6	00
Vino Tinto	3	0	00	6	4	00	1	6	00	2	0	6	00
Tockay	2	2	00	4	3	00	5	0	00	2	0	3	00
Tyrol red Wine	1	4	00	1	2	00	0	4	00	2	8	6	00
Red Wine	1	6	00	0	4	40	0	2	00	2	9	3	20
White	2	0	00	0	7	00	0	3	00	2	7	0	00

From these experiments it appears that the red Wines of our own country [the Marche of Brandenburg] contain moſt water, Malmſey moſt ſpirit, Vino Tinto moſt unctuous matter, and Spaniſh the moſt gummy and ſaline matter: that this laſt holds the leaſt water and the leaſt ſpirit, Champagne the leaſt Tartar and Mucilage, and ordinary Rheniſh the leaſt unctuous matter.

Altered irrecoverably, by the ſeparation of any of their principles.

When once the principles of Wine are ſeparated from one another, no art can reproduce Wine by joining them together again: When barely the inflammable ſpirit has been diſtilled off, the addition of that ſpirit to the reſiduum does not reſtore its vinoſity: The reſiduum itſelf, often ſuffers a new ſeparation upon this addition; its tartareous parts precipitating,

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Congelation.

When Wines are expoſed to the action of a freezing air, a part of their water congeals, and the unfrozen part proves proportionably ſtronger and more ſpirituous: By repetitions of this proceſs, firſt pointed out by Paracelſus and ſince carried to a greater length by Stahl, the beſt wines are reduced to about one ſixth of their original volume. Wines thus concentrated or freed from their redundant phlegm, are no longer the delicate liquors they were before: they are too unpleaſant, as well as too ſtrong to be drank by themſelves, and when mixed with other Wines, communicate to them alſo a diſagreeable taint. The phlegm which congeals retains a part of the truly vinous matter, as appears from its being convertible into Vinegar; but this phlegm, mixed with the unfrozen Wine, does not reſtore its priſtine qualities: Both the phlegm by itſelf, and the mixture, ſoon corrupt.

MALT LIQUORS.

MALT LIQUORS.

Subjects of vinous fermentation.

SWEET vegetable liquors are the only ones diſpoſed to vinous fermentation. The ſeveral kinds of grain, as Barley, Wheat, Rye, Oats, Buck-wheat, *&c.* and the ſeeds of leguminous plants, as Peas, Tares, Lentils, *&c.* when they begin to vegetate, are remarkably ſweet; and in this ſtate, called Malt, they readily communicate their fermentable ſweetneſs to boiling water.

Malt.

Malt is prepared chiefly from Barley, by ſteeping it in water till it ſoftens and ſwells, and then laying it in heaps till it begins to ſprout: When this happens, the vegetation is ſtopt by ſpreading it abroad thin, and afterwards completely drying it by the ſun's heat where that heat is ſufficient, or in kilns warmed by culinary fire: According as the heat is leſs or greater, the Malt itſelf, and the tincture which it gives to water, are of a paler or a browner colour. Different ſorts of grain differ in their facility of vegetation: The ſame ſort alſo vegetates ſooner or later according as it is new or old. Hence the improprie-

Malt Liquors.

ty of malting different ſorts, or one ſort of different ages, together: The proceſs ſhall be finiſhed in one before it is begun in another; ſo that either a part muſt remain unmalted, or a part muſt be overmalted: In this laſt caſe, the infuſion of the compound is diſpoſed according to the proportion of the unmalted part, to an acid rather than a vinous ſtate.

Differences of ferments.

Infuſions of Malt, or watery ſolutions of its ſweet matter, have leſs propenſity to fermentation than the juices of ſweet fruits, and require always the aſſiſtance of Yeaſt or ſome other actual ferment. The quality of this ferment greatly influences that of the liquor: It ſeems in ſome meaſure to aſſimilate, as it were, the whole maſs of liquor to its own nature, or to that of the liquor from which it was taken. How different are the products obtained from infuſions of the ſame Malt, by uſing Yeaſt of Beer, and the Yeaſt or Lees of generous Wine for a ferment! How ſmall a portion of putrid Yeaſt is ſufficient to ſpread putrefaction through immenſe quantities of wort! When waters uſed for brewing have received an impregnation from the carcaſes of animals, though ſo ſlight as not to be perceived in the water itſelf; as ſoon as the liquor has been brought into fermentation, the putrid ferment has exerted its activity, and diſpoſed the fermentation to its own kind—— Great differences are obſerved in waters in regard to their fitneſs for brewing: It is remarkable that the waters of rivers, and of ſtagnant ponds that are not putrid, though quite muddy, and unfit for drinking, and even diſguſtful, produce better Beer than thoſe of the fineſt and moſt limpid ſprings. Perhaps it is their ſoftneſs that adapts them to this uſe, whilſt their impurities are ſeparated in the courſe of the fermentation.

Differences of Waters.

Fermentability.

Though infuſions of Malt are of themſelves little diſpoſed to vinous fermentation; when once that proceſs has begun, they tend ſtrongly to run beyond it: In very hot weather, the fermentation can ſcarcely be checked at the period of true vinoſity. Hence Malt-liquors are moſt ſucceſsfully prepared in the Winter

and

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d Spring: And hence the warm climates can hardly make any tolerable Beer.

Hops.

Theſe liquors are rendered much more durable, leſs apt to grow ſour, leſs viſcid, and in general more wholeſome, by the aromatic bitterneſs of the Hop. The hop contains a ſubtile odorous principle, which promotes the effect of the vinous fermentation: If infuſed, or but lightly boiled in the wort, it ſenſibly increaſes the ſpirituoſity: If boiled for a longer time, its volatile principle is diſſipated, the beer proves bitterer, but receives no additional ſtrength.

Inebriative additions

Sundry other ſubſtances have been employed for augmenting the inebriative power of malt-drinks to the injury of their ſalubrity; as Clary, Cocculus indus, and the plant called Bohemian Roſemary (*Ciſtus ledon foliis roriſmarini ferrugineis C. B.*) which laſt produces a quick a raving intoxication. Often-times alſo different medicinal ſubſtances are added, with a view to render the liquor ſerviceable in particular diſeaſes. The active powers of many vegetables are not only effectually extracted, but extended and multiplied as it were, by fermentation: So much pounded nutmeg as will lie on the point of a knife, gives a flavour to a large vat of fermenting beer; whereas, when the fermentation is finiſhed, the quantity to which it gives a like impregnation, is comparatively inconſiderable.

Activity of vegetables increaſed by fermenting liquors.

Contents of different Malt liquors.

I have examined ſeveral of the German malt liquors, both pale and brown, in regard to their quantity of ſpirit, the quantity of ſolid matter left upon inſpiſſating them, and their degree of acidity, for they are all found, even in their ſoundeſt ſtate, to be more or leſs acid: The acid principle cannot perhaps be collected ſeparately, but it readily diſcovers itſelf by neutralizing fixt alcaline Salts. The ſtrongeſt of the liquors I examined yielded, upon the quart, ten drams of inflammable ſpirit: and the weakeſt of thoſe that are called Strong-beers, five drams: Of common Table-beers, ſome gave four and ſome three drams. The ſolid matter amounted in ſome to near five ounces, in others only to one ounce three drams; in the Table-beers, to three ounces and a half. The largeſt

Malt Liquors.

quantity of fixed alcali, ſaturated by a quart was [illegible] drams thirty-four grains: and the ſmalleſt, one dram twelve grains.

It is obſervable, that when Malt-liquors turn ſour, the bitterneſs of the hop, though ſtrong before, is covered or over-powered by the acidity. It is not, however, deſtroyed: On adding an alcaline Salt or abſorbent Earth, in ſufficient quantiy to obtund the acid, the liquor taſtes bitter again as at firſt.

INFLAMMABLE SPIRIT.

Vinous Spirits.

Differences in them, as firſt diſtilled.

INFLAMMABLE Spirits are extracted from fermented liquors by diſtillation. As firſt diſtilled, they abound with phlegm, and contain ſo much of the groſs Oil of the ſubject, that has not been attenuated or thrown off by the fermentation, as to receive from thence particular flavours. Thoſe drawn from Malt-liquors are in general nauſeous; thoſe from Wines more grateful. The Brandies of France are all obtained from Wine, thoſe of Germany from Malt: In England, a ſpirit is prepared from Malt for inferior uſes, and a finer one from Melaſſes, or the ſyrupy matter, which ſeparates in the making or refining of Sugar: The rums of the American iſlands are likewiſe the produce of the Sugar-cane (q).

Methods of determining their ſtrength

There are different methods of eſtimating the ſtrength of theſe ſpirits—— 1. On ſhaking a little in a

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(q) *Spirit from Malt, &c.*] Malted barley affords the largeſt quantity of Spirit of any kind of grain that has been tried, except Rye, which is ſaid by ſome to yield near one third more. In the Swediſh Tranſactions, there are ſome experiments of diſtilling a ſpirit from potatoes. Sixteen meaſures of potatoes were boiled with Water, and worked with the liquor till the whole became a tough dough: This was diluted wit[illegible] boiling water to the conſiſtence of thin gruel, and fermented: The fermentation went on well, and the liquor diſtilled on the third day, yiel[illegible]ed one meaſure of good Brandy. The potatoes did not ſettle, or bur[illegible] to the ſtill, as might have been ſuſpected. The author, Mr. Skytte[illegible] makes a compariſon, from this experiment, of the profits in cultivati[illegible] Potatoes and Barley for the purpoſes of diſtillation: He computes, that the produce of ſpirit from Potatoes is to that from Barley, in equal extents of ground, as 566 to 156, even admitting the potatoes to be planted in the worſt kinds of ground, and the Barley in ſo good a ſoil as to yield an increaſe of fifty fold.

VINOUS SPIRITS.

Vial, a number of bubbles riſe upon the ſurface: The more numerous the bubbles, and the more quickly they diſappear, the more ſpirituous is the liquors. 2. If ſome of the Spirit be poured upon Oil Olive, or Oil of Almonds, the Oil ariſes to the ſurface, more or leſs haſtily according as the liquor contains more or leſs phlegm: In pure ſpirit it does not riſe at all. 3. The hydrometer is a very convenient inſtrument for determining the ſtrength of theſe liquors: It conſiſts of a glaſs ball with a ſlender ſtem divided into a number of equal parts, adjuſted in regard to weight, ſo as to ſink to a certain point in ſpirit of a determined ſtrength; thoſe ſpirits in which it ſinks further or not ſo far, are proportionably ſtronger or weaker than the ſtandard. 4. Some ſet the brandy on fire, and judge of its ſtrength from the quantity of phlegm or water that remains after the burning: Such as leaves half its quantity is held to be of a ſufficient ſtrength for brandy, and called proof. The phlegm thus freed from the ſpirituous part will readily diſcover by its taſte, how much or how little the brandy participated of nauſeous matter (*r*).

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(*r*) *Methods of eſtimating the ſtrength of ſpirits.*] Of all theſe methods, that by the hydrometer appears to be the moſt accurate. The hydrometer ſhould be graduated for this purpoſe, by marking the height to which it ſinks in pure Water, in pure ſpirit, and in mixtures of different proportions of the two; for dividing the ſtem into a number of equal parts betwixt the two extremes will not anſwer. It is the ſpecific gravity of the liquor that this inſtrument meaſures, and the ſpecific gravity of mixtures of water and ſpirit does not correſpond to the mean gravity of the two ingredients. In theſe mixtures, as in ſundry metallic ones formerly mentioned, there ſeems to be more than a bare juxtapoſition of the particles of the two fluids; a part of one ſeems to be received within the pores or vacuities of the other. If a certain volume of pure water weighs 1000, the ſame volume of the pureſt Alcohol or moſt highly rectified ſpirit will weigh 820; the ſame volume of a mixture of equal parts of the two will weigh, not the medium 910, but nearly 925. If one meaſure of water and one meaſure of ſpirit be mixed together, the quantity of the mixture will be very ſenſibly leſs than two meaſures.

From the riſing or ſinking of Oil in the ſpirit we can form only a groſs judgment of what the hydrometer (if the liquor is brought to an equal temperature in regard to heat) meaſures with preciſion. The quantity of bubbles on the ſurface depends rather on the oilineſs of the ſpirit than on its ſtrength; for weak ſpirits may be made to exhibit the ſame phænomena in this reſpect as the ſtronger, by impregnating them with Oil;

VINOUS SPIRITS.

Are ſimilar when rectified.

Rectification.

Inflammable ſpirits, perfectly purified from their phlegm and their groſs Oil, are not found on any trial to differ or to be diſtinguiſhable from one another, whatever ſubject they were produced from. The purification is effected by repeated diſtillations in a gentle heat. Particular diſtilling veſſels, have been contrived for this purpoſe, of a ſpiral form and an extraordinary height: Through theſe it was expected that the lighter ſpirit would ariſe pure, leaving all the water in its paſſage. I have tried the celebrated ſerpentine in the royal elaboratory of Paris, but without the pretended ſucceſs: The Water, by a boiling heat, paſſed through every curvature and circumvolution of the inſtrument, along with the ſpirit, and the diſtilled ſpirit was juſt as plegmatic as if the common ſtill had been uſed. This pompous and expenſive apparatus has therefore no advantage above the common one; the purity of the Spirit from Water, depending in either caſe, ſolely upon the gentleneſs of the fire. The ſpirit in its ſeparation from the phlegm leaves alſo greateſt part of the nauſeous oily matter behind, but oftentimes a part comes over with it: If the diſtilled Spirit be mixed with a quanity of pure Water, its Oil is extricated by the Water, and on careful rediſtillation it ariſes pure from both. Sundry additional matters have been employed for expediting the proceſs by abſorbing and detaining the Oil and Phlegm; as fixed alcaline Salts, Sea-ſalt, Quick-lime, *&c.* Fixt alcalies anſwer the beſt: By theſe, ſpirits may be rectified even without diſtillation. If a quantity of pure and dry fixed alcaline Salt be put into a phlegmatic Spirit, it imbibes the phlegm and the oily matter, and forms with them a thick ponderous liquid, which falls to the bottom, and from which the

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Oil: From inattention to this circumſtance, ſome of the workmen have been miſled into an opinion, that the ſpirit proves ſtronger when the fire in the diſtillation is kept to ſuch a height as to make the ſpirit run in a full ſtream, than when a gentler fire is uſed; a ſtrong heat forcing over more of the Oil, and conſequently making the ſpirit aſſume a greater quantity of bubbles on being ſhaken. In regard to the quantity of water left on burning, it depends more upon the manner in which the ſpirit is burnt than upon its ſtrength, as will appear hereafter.

Spirit

Spirit may be eaſily poured off: How ſtrongly ſoever the two liquors are ſhaken together, they preſently ſeparate upon ſtanding at reſt. Spirits thus rectified are not entirely pure: They contain ſome ſmall portion of the alcali, ſufficient to communicate a degree of pungency, that may render them for ſome purpoſes unfit (s).

Spirit of Wine, is the general name of rectified Spirits, whatever ſubject they were prepared from; but is never applied to proof ſpirits though drawn from Wine itſelf. Spirits brought to the higeſt degree of purity, both from Phlegm and Oil, are called Alcohol. By diluting rectified ſpirit with a ſuitable quantity of pure water, we obtain a pure and flavourleſs proof ſpirit. When phlegmatic or proof-ſpirits are required for chemical or other curious uſes, they ought always to be prepared in this manner (t).

Criteria of highly rectified ſpirit

Spirit of Wine, ſet on fire in a ſpoon, or ladle, burns wholly away, without leaving any ſenſible humidity. A little Gunpowder, placed at the bottom, takes fire as ſoon as the ſpirit is burnt off; and this is the common mark of the ſpirit being ſufficiently rectified; for if it contains any conſiderable quantity of phlegm, this phlegm remaining after the ſpirit is conſumed, will prevent the Gunpowder from taking fire. The makers of varniſh, who require very ſtrong ſpirits, prefer Cotton as a nicer teſt, this being

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(s) *Part of the alcali retained by the ſpirit.*] A part of the alcali ariſes alſo along with the ſpirit in diſtillation, and communicates to it what the workmen call an urinous flavour. This may be prevented by adding an acid, particularly the vitriolic, previous to the diſtillation: the acid not only neutralizing the alcaline Salt, but preventing it from ariſing. It would be imprudent to add the vitriolic acid in its pure ſtate, as we could not aſcertain the proper quantity: but Vitriol itſelf, or Alum, may be uſed with ſafety, as theſe will part with no more of their acid, in the degree of heat by which vinous ſpirits are diſtilled, than what the alcali abſorbs:

(t) *Proof ſpirits from rectified ſpirit and water.*] Proof ſpirits are ſaid to be compoſed of equal parts of rectified ſpirit and water. If the two liquors are taken by meaſure, this proportion will pretty nearly make a ſpirit of the ſtrength commonly underſtood by proof. The exact proportions, by weight, are, one hundred parts of pure ſpirit, and eighty-ſix of water.

VINOUS SPIRITS.

leſs eaſily inflammable than gunpowder; and a ſmaller proportion of aqueous humidity preventing its burning. A ſpirit that fires Cotton is looked upon as quite pure from phlegm.

Analyſis of rectified ſpirit.

Though rectified ſpirits give no ſigns of water upon theſe trials, a further examination diſcovers that they abound with that element. Burn the ſtrongeſt ſpirits in a deep mortar, or in a veſſel kept floating in cold water, and a quantity of moiſture will remain unconſumed. I made ſeveral experiments on this ſubject at Paris, in concert with the younger Geoffroy, who afterwards gave an account of them to the French Academy: From the beſt ſpirits, ſuch as fired both Gunpowder and Cotton, we gained, by burning them in the open air, as one third their weight of water; and under an open glaſs receiver, one half. I have ſince collected much larger quantities, by burning the ſpirit in an apparatus which ſuffered leſs of the phlegm to eſcape into the air.

Pure ſpirit is in effect, no other than an intimate combination of water with an Oil; not ſuch an Oil as we ſeparate in the rectification, but one that has been highly ſubtilized by the proceſs of fermentation: An actual Oil is obtainable from the pureſt ſpirit, by diſtilling it with the vitriolic acid. Theſe ſpirits contain alſo a portion of acid, which probably ſerves as the band of union between the Oil and the water: On repeatedly abſtracting freſh quantities of them from one and the ſame parcel of fixed alcaline Salt, the Salt becomes at length neutral, and nearly ſimilar to alcalize neutralized by Vinegar.

Vinous ſpirits as menſtrua.

Vinous ſpirits are of very extenſive uſe in chemiſtry and the chemical arts; as for ſeparating the medicinal parts of vegetable and animal ſubſtances, from the inactive matter; extracting their flavours and colours for various uſes; diſſolving Reſin and Oils for varniſhing and lacquering; preſerving animal and vegetable bodies from corruption.

Spirit of Wine diſſolves all vegetable Reſins and diſtilled Oils, the ſubtile Oils of aromatic herbs, flowers, ſeeds and fruits, as Lavender, Balm, Mint,

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Marjoram, Citron-peel, very readily and plentifully; thoſe of woods and roots, as Rhodium and Saſſafras, more difficultly and ſparingly; thoſe diſtilled from reſinous ſubſtances, as Turpentine, and from mineral bitumens as Amber, ſtill more difficultly. It diſſolves empyreumatic Oils as well as the eſſential; and by diſtillation and repeated cohobation, renders them extremely ſubtile. Pure expreſſed Oils, and animal Fats, it does not unite with at all; but theſe alſo are rendered ſoluble in it by combining them with fixed alcaline Salts into Sope. It mingles with water, and produces a conſiderable heat on being mixed with it. It coagulates Blood, Milk, and whites of Eggs, and moſt of the animal juices, except Urine and Bile. It mingles with all acids, concentrated and diluted, of the mineral or vegetable kingdom: On its mixture with the concentrated mineral acid ſpirits, a ſtrong ebullition and heat enſue, the acidity is obtunded or deſtroyed, and the compound proves a ſubtile, volatile, fragrant fluid (*u*). It does not act in the leaſt upon

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(*u*) *Combination of vinous ſpirits with mineral acids.*] Spirit of Wine produces the greateſt heat and ebullition on mixture with the nitrous acid; and the leaſt with the marine. The conflict is conſiderably more violent, and the noxious fumes more copious, when the vinous ſpirits is dropt into the acid, than when the acid is dropt into the vinous; a circumſtance to be carefully attended to by the operator in making theſe mixtures, eſpecially when the quantities are large. When the two ſpirits are intimately combined together into a fragrant liquor, in which no acidity can be perceived, the acid is ſaid to be *dulcified*. The union is promoted by digeſtion; but the dulcification is never perfect without a ſubſequent diſtillation. As ſome ſingular phænomena occur in theſe operations, it will be proper to conſider them more particularly.

With the vitriolic acid.] Concentrated Oil of Vitriol being dropt by degrees into an equal quantity, or five or ſix times its quantity, of highly rectified Spirit of Wine, the liquor becomes firſt yellow and then reddiſh, and exhales an agreeable, diffuſive, penetrating ſmell, which if freely taken in with the breath, affects the lungs: The taſte of the liquor is conſiderably acid.

On digeſting the mixture for ſome days, and then committing it to diſtillation in a retort with a very gentle warmth, there ariſes a ſubtile ſpirit, more fragrant and penetrating in ſmell than the undiſtilled liquor, very volatile, inflammable, in taſte not all acid, but of the aromatic kind. This is the dulcified Spirit of Vitriol. It comes over in thin inviſible vapours, which condenſe upon the ſides of the recipient in ſtreight ſtriæ.

This ſpirit is ſucceeded by one of a different kind; which being caught in a ſeparate receiver, is found to be ſenſibly acid, and of a pungent

Vinous Spirits.

upon pure Sulphur; but from Sulphur combined with fixed alcaline Salts, it receives a deep yellow tincture,

gent ſuffocating ſmell like the fumes of burning Brimſtone. Along with it comes over a ſmall quantity of Oil; which ſometimes proves colourleſs and ſwims on the ſulphureous liquor, and ſometimes appears yellowiſh or greeniſh and ſinks to the bottom, according as the vinous ſpirit in the mixture was in large or in ſmall proportion.

In all the diſtillations I have made, this ſulphureous ſpirit aroſe in white fumes, which either formed irregular ſtriæ, or were collected into large round drops like Oil; The appearance of theſe fumes conſtantly gave notice of the time for changing the receiver. Mr. Hellot ſays, that in perfectly cloſe veſſels, theſe vapours are not to be diſtinguiſhed, any more than thoſe of the dulcified ſpirit; that when the retort was made to fit exactly into the receiver, the neck being ground with Emery for that purpoſe, they were not to be ſeen till the juncture was looſened a little; and that on looſening, and ſtopping it tight, they appeared and diſappeared for ſeveral times ſucceſſively.

On continuing the diſtillation, a black froth begins haſtily to ariſe, and prevents our carrying the proceſs further. The matter which remains in the retort, is of a dark blackiſh colour, and ſtill highly acid. Treated with freſh Spirit of Wine, in the ſame manner as before, it yields the ſame productions, till at length, all the acid that remains unvolatilized being ſatiated with the inflammable oily matter of the ſpirit, the compound proves a bituminous ſulphureous maſs; which expoſed to the fire in open veſſels readily burns, leaving a conſiderable quantity of fixed aſhes; in cloſe ones, explodes with violence; and with fixed alcaline Salts forms a compound ſimilar in ſome reſpects to one compoſed of alcalies of Sulphur.

The author above-mentioned has diſcovered a method of facilitating this proceſs, in regard to the preparation of the dulcified ſpirit. By the addition of powdered Potter's-earth, in the proportion of ſix ounces to eight ounces of the acid and ſixteen of the vinous ſpirit, the ſulphureous liquor and the Oil that accompanies it are prevented, he ſays, from ariſing; and the diſtillation may be ſafely performed even with a boiling heat, and continued till the matter remains dry. See the Memoirs of the French Academy for the year 1739.--It is probable, that the only uſe of this addition is, to abſorb the ſuperfluous acid; for the author obſerves that greateſt part of the Oil of Vitriol is recoverable from the Clay, by diſtilling it with a ſtronger fire. Perhaps a ſuitable diminution in the quantity of acid employed might anſwer the ſame end. Thus much is certain, that when ſix parts of the vinous ſpirit are taken to one of the acid, the quantity both of ſulphureous liquor and Oil is conſiderably leſs than when the two ſpirits are taken in equal proportions.

The Oil is of a ſtrong, penetrating, agreeable ſmell, reſembling that of the dulcified ſpirit: It very readily and totally diſſolves in rectified Spirit of Wine, and impregnates a large quantity of the menſtruum with its own odour. To the taſte, it is ſenſibly acid, eſpecially when a large proportion of acid has been employed in the proceſs: On keeping for ſome time, it becomes more remarkably ſo, acquiring at the ſame time a reddiſh hue. In this ſtate, it diſcovers a ſulphureous ſmell, effervesces with and neutralizes alcaline Salts, and being thus freed from its acid, ariſes in diſtillation more ſubtile than before, and vaſtly diminiſhed in quantity.

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tincture, and a notable taſte and ſmell. It has been ſaid to diſſolve no ſolid Salts; but on trial it is found

Vinous Spirits.

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*The dulcified ſpirit alſo has frequently ſome ſlight acidity, ſufficient to alter the fine green tincture, which in its perfect ſtate it extracts from the leaves of plants. It is purified or rectified from this redundant acid, by mixing it with a weak ſolution of fixed alcaline Salt, and diſtilling it over a ſecond time; For every pint of the ſpirit may be taken a ſolution of a dram of Alcali in a pint of water.

If the ſpirit, thus rectified, be mingled again with an equal quantity of a like alcaline ſolution, the mixture ſhaken together, appears milky: On ſtanding for a little time, there ariſes to the ſurface an extremely ſubtile fluid, called by the chemiſts Æther, or Æthereal Spirit of Wine. A conſiderable quantity of dulcified ſpirit may ſtill be ſeparated from the remaining liquor by diſtillation; and this ſpirit, mixed with freſh alcaline ſolution, affords more Æther.

The Æther is, the lighteſt, moſt volatile, and moſt inflammable of all known liquids. It ſwims on the moſt highly rectified Spirit of Wine, being lighter than that ſpirit in proportion nearly of 0,730 to 0,830. Dropt on the warm hand, it almoſt inſtantly exhales, diffuſing a penetrating fragrance, and leaving no moiſture behind. On the approach of a candle, it takes fire, and goes off in a flaſh like lightening. It does not mingle with water, with acid, or with alcaline liquors; but diſſolves ſome unctuous and reſinous bodies. Among metallic ſubſtances, it diſcovers a remarkable attraction to Gold, but ſeems to have no effect on any of the others: Mixed with a ſolution of Gold made in acids, it imbibes the Gold from the acid, carries it to the ſurface, and keeps it there diſſolved into a yellow liquor; hence its uſe for diſcovering Gold in liquids. See page 39.

The only perſon we know of, who has given any plauſible theory of the production of this ſubtile fluid, is Mr. Macquer---Spirit of Wine conſiſts chiefly of an Oil, exquiſitely attenuated by fermentation, and intimately combined with water. According to Mr. Macquer, the Æther is no other than this ſubtilized Oil, extricated by the vitriolic acid; which acid, having a ſtrong affinity or attraction to water, abſorbs the watery element of the ſpirit, and thus ſets the oily one at liberty.

In the *Svenſka vetenſkaps academiens handlingar, är* 1740, there is a remarkable experiment on the dulcified vitriolic ſpirit (or perhaps the Æther, for the author expreſſes himſelf a little ambiguouſly) by J. G. Wallerius. Some Salt of Tartar being mixed with the ſpirit, the full bottle ſtopt with a cork, tied over with bladder, and laid on its ſide; on ſtanding for four months, greateſt part of the ſpirit was found to have eſcaped, and the Salt was ſhot into hexangular priſmatic cryſtals like Nitre. It taſted ſtrongly of the ſpirit, but had no other particular taſte: Laid on a burning coal, it crackled and exploded with a bright flaſh, and flew with violence into the air. He afterwards found, that by adding to the ſpirit a drop or two of any acid, the Salt cryſtallizes the ſooner; that in this caſe it proves of a ſouriſh taſte, but in other reſpects is the ſame as that made without the acid. This Salt-petre, ſays the author, promiſes, from the violence of its exploſion, to make the ſtrongeſt Gunpowder in the world, but a very dear one: Though the experiment ſhould not be applicable to any uſe in this way, it will probably contribute to illuſtrate the generation of Nitre, as it palpably ſhews Nitre (that is the acid or characteriſtic part of Nitre) produced from the vitriolic acid and phloto diſſolve perfectly the Sal diureticus, nitrous Sal ammoniac, the Salt called fixed Sal ammoniac, the cryſtals

With the nitrous acid.] Strong Spirit of Nitre being dropt by little and little into three or four times its quantity of rectified Spirit of Wine; and the mixture, after digeſtion for ſome days, diſtilled by the heat of a water bath, there ariſes a fragrant ſpirit, in ſome degree reſembling the dulcified Spirit of Vitriol; but which, when rectified in the ſame manner, does not, ſo far as I have obſerved, afford any Oil or Æther. The ſpirit is to the taſte gratefully pungent, not at all acid like the one ingredient, nor hot like the other: Mixed with clean Malt or Melaſſes ſpirits, it communicates a flavour like that of French Brandy. It is conſiderably leſs inflammable than Spirit of Wine, and leaves on burning an acidulous phlegm.

It is obſervable, that the vitriolic acid, in the foregoing proceſs, diſcovers itſelf in moſt of the products by its uſual characters, plainly in the ſulphureous diſtilled liquor and in the Oil that diſtils along with it, and ſtill more plentifully in the reſiduum; whilſt the whole of the nitrous acid, in the preſent proceſs, ſeems to be deſtroyed or to change its nature. To deflagrate with inflammable ſubſtances in burning, is the ſtrongeſt character of the nitrous acid; but neither the dulcified ſpirit, nor the alcidulous liquor remaining after it has been burnt, nor the matter left in the retort after the diſtillation, have been obſerved to produce any deflagration.

Mr. Pott, in a diſſertation on this ſubject, has given ſome curious experiments on the oleaginous reſiduum of the diſtillation--Diſtilled by a ſtronger fire, it gave over a yellow acid ſlightly empyreumatic ſpirit; which being ſaturated with fixed alcali, the liquor evaporated, and the dry neutral Salt laid on burning coals, no deflagration enſued. After this ſpirit, aroſe a red empyreumatic Oil; and in the bottom of the veſſel remained a ſhining black maſs like Soot, which burnt in a crucible left a white fixed earth, convertible by a vehement fire into a Glaſs---Another parcel of the above reſiduum was evaporated to the conſiſtence of Pitch: In this ſtate, it gave a yellow tincture to Spirit of Wine, flamed vividly and quietly on burning coals, and at laſt ſwelled up like Bitumens—Another portion was ſaturated with alcaline Ley (with which it immediately effervesced) and then evaporated as the former: It gave as before a yellow tincture to rectified Spirit of Wine, and a much deeper yellow to the dulcified Spirit of Nitre; and in the fire diſcovered no footſtep of detonation—Mr. Macquer, who mentions ſome of theſe experiments without giving them their full force, ſuſpects that the acid obſerved in them was not the nitrous changed in its quality, but the acid of the Spirit of Wine extricated by the nitrous. But what is become then of the nitrous acid, of which ſo large a proportion was made uſe off?

Though the nitrous acid does not ſeparate any æthereal Oil from Spirit of Wine, by diſtillation in a gentle heat, as the vitriolic does; it ſeparates one by ſimple mixture, and digeſtion without heat, which the vitriolic does not. Equal parts by meaſure of Spirit of Nitre and Spirit of Wine being mixed together, the bottle cloſely ſtopt, and ſet in a cool place; the æthereal Oil, in ſeven or eight days, ariſes to the ſurface, amounting to upwards of one fourth the quantity of the mixture. This Oil contains a part of the nitrous acid unchanged: From which it is purified by diſtillation from alcaline liquors, and is then called rectified nitrous æther. This experiment was firſt diſcovered by Mr. Navier, and communicated in the Memoirs of the French Academy for the year

1742.

Vinous Spirits.

cryſtals of Silver made with the nitrous acid, and combinations of Iron, and ſome other metallic bodies with the marine; and more difficultly Sugar, Saccharum ſaturni, and Salt of Amber: It takes up a little alſo, about one ſixth, of green Vitriol, and of Borax. Added to watery ſolutions of Salts, it in ſome caſes occaſions an inſtantaneous precipitation of the Salt, by rendering the water incapable of keeping it diſſolved: With ſome ſolutions it produces a coagulum: From ſome it precipitates the earthy or metallic baſis of the Salt, the acid being abſorbed by the ſpirit. It revives Gold from its ſolutions in form of fine Gold-leaf, and precipitates Mercury in its running form: It precipitates alſo Tin and Lead. It does not act, or at leaſt not conſiderably, upon pure alcaline Salts, either fixed or volatile, nor mingle with ſolutions of them made in water; It abſorbs the water from ſolutions of volatile alcalies, and thus precipitates the Salt; but on ſolutions of fixed alcalies it has no effect, the ſpirit ſwimming diſtinct upon the ſurface of the alcaline liquor, and quickly ſeparating from it, though they be ſtrongly ſhaken together, as Oil does from water.

TARTAR.

Tartar. Its production.

THE groſs Salt, or Tartar, contained in Wines, does not diſſolve at all in ſpirit, and very ſparingly in watery liquors: By age, Wines become

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1742. It does not require the two ſpirits to be very ſtrong, and is performed with the greateſt ſafety to the operator when they are but moderately ſo: When both of them are highly concentrated, there ſometimes happens, during the digeſtion, a violent exploſion.

With the marine acid.] The marine acid unites with vinous ſpirits very difficultly and imperfectly: When combined with them by long digeſtion, and diſtillation it manifeſts its own ſpecific characters, and ſeems to be only diluted by the inflammable liquor. The ſpirit, diſtilled in the heat of a water bath from one part of ſmoking Spirit of Salt and three or four of highly rectified Spirit of Wine, after twenty days digeſtion, efferveſces with fixed alcalies, forms with them a regenerated Sea-ſalt, and precipitates Silver from its ſolution in Aqua fortis into Luna cornea. The matter left after the diſtillation yields, on being urged with a greater heat, a weak marine ſpirit, ſlightly empyreumatic, a pitchy or coaly matter remaining which by calcination turns to white aſhes.

TARTAR. more and more ſpirituous, and the Tartar proportionably ſeparates and incruſtates on the ſides and bottom of the caſk. It proves of a whitiſh, yellowiſh or reddiſh colour according to that of the Wine; and more or leſs foul according as the Wine abounded more or leſs with groſs unctuous matter. The white is purer than the red; and that which ſeparates after the Wine has been long kept; than ſuch as is thrown off immediately after the fermentation.

This ſalt is the direct produce of fermentation, and is never to be obtained from liquors which have not undergone that proceſs. The rich ſweet Wines afford leaſt; not as Boerhaave ſuppoſes, from the oily matter preventing its ſeparation, but from their really containing leaſt, as having been leaſt perfectly fermented. The Rheniſh, Franconia, and Moſelle Wines yield the moſt of any.

Purification. Tartar is always the ſame Salt, whatever Wine it be produced from; the only difference that ariſes from the Wine being in the quantity of foul matter depoſited along with it. It is purified by boiling it in water, till the ſaline part is diſſolved, and clarifying the ſtrained ſolution with whites of Eggs: The liquor being then removed into a cool place, the Salt ſoon begins to concrete into very ſmall white cryſtals.

Tartar is refined in large quantity at Venice, Montpelier, Tripoli, and in ſome parts of Germany; the Cryſtals we are ſupplied with from thoſe works are ſomewhat whiter, and much larger, than any I have been able to prepare: and at the ſame time of a cheapneſs ſcarce conſiſtent with the troubleſome proceſs of diſſolving and clarifying the Tartar by itſelf. Some of the chemiſts of the French Academy have taken great pains to diſcover the method of managment in the Tartar refinery at Montpelier, and report, that the ſecret conſiſts in employing a chalky earth, which promotes the ſolution of the Tartar. I have never been able to ſucceed with chalky or with other earths, nor with any of the additions I have made trial of. Chalk and abſorbent earths in general do indeed promote the ſolution

ſolution of the Tartar, but they unite with it into a new compound of a quite different nature; whereas the common Cryſtals were found on all trials the ſame with Tartar purified by itſelf.

TARTAR.

Its general properties.

Tartar is a manifeſtly acid Salt: It does not, however, change the colour of Syrup of Violets to a red, the oily matter, with which it abounds, covering its acidity. Diſſolved in water, it effervеſces with fixed alcaline Salts, and forms with them a neutral one, much eaſier of ſolution than the Tartar alone. It likewiſe effervеſces with and diſſolves abſorbent earths, and with theſe alſo forms a neutral ſoluble compound, from which the Tartareous acid may be expelled by the more powerful ones of the mineral kingdom. It diſſolves the metallic ſubſtances that other vegetable acids do, as Iron, Copper, Lead, *&c.* (*x*).

Tar-

(*x*) *Tartar.*] The acid of Tartar, has been ſuppoſed by ſome to be ſimilar to that of Vinegar, but is found upon experiment to be notably different. It does not, like the acetous acid, render fixed alcalies ſoluble in Spirit of Wine, nor form a ſaccharine concrete with Lead. When combined with alcaline Salts, or with abſorbent earths, into a neutral Salt: Vinegar, as well as the mineral acids, added to a ſolution of this Salt, precipitates the Tartar in its original form, and unites with the alcali or earth in its ſtead.

It is obſervable, that all the ſubſtances which unite with Tartar, form with it compounds eaſier of ſolution than the Tartar by itſelf, thoſe of the metallic kind not excepted. Thus if Tartar and Iron-filings be boiled together in water, the liquor ſoon acquires a dark colour and a ferrugineous taſte: On cooling, ſuch part of the Tartar as is but ſlightly impregnated with the Iron, falls to the bottom in a cryſtalline form, The part which is fully ſaturated remaining diſſolved in the cold: If the fluid be now evaporated, it leaves a ſaline maſs, ſo eaſy of ſolution, that it runs into a liquor on being expoſed to the air. The addition of alcaline Salts to this ſolution does not ſeem to precipitate the Iron from the tartareous acid, but on adding any other acid, the Tartar is precipitated, the Iron which made it ſoluble being abſorbed from it by the acid ſuperadded. Nearly, the ſame phænomena, are obſerved on treating Tartar with Copper, Lead, Zinc, and Regulus of Antimony, except that the combinations with theſe metals are leſs diſpoſed to deliquiate.

Tartar ſaturates about one third its weight of fixed alcaline Salt, but more than equal its weight of abſorbent earth. If the Tartar be diſſolved in boiling water, and the proper quantity of the alcali or earth be gradually thrown into the boiling liquor; the whole of the Tartar will be ſaturated at once, ſo as to yield on cryſtallization a Salt perfectly neutralized and eaſily ſoluble. Metallic bodies on the other hand, though long boiled with a ſolution of Tartar, ſaturate only a part of it,

and

TARTAR. **Reſolution by fire.** Tartar, expoſed to the fire in cloſe veſſels, gives over a fetid acidulous ſpirit, and an empyrumatic Oil. The remaining coal, elixated with water, yields a large proportion of fixed alcaline Salt, whilſt no ſuch Salt is producible from open air. From a pound of Tartar were extracted about four ounces of ſpirit and Phlegm, and one of Oil: The reſiduum weighed ten ounces and a half, and yielded four ounces of alcaline Salt. This is the alcali which has been chiefly made uſe of in chemical experiments, by the name of ſalt of Tartar: It is not different in quality from the alcalies obtained from other vegetables, though it ſeems to have been looked upon by ſome as participating of the nature of the Tartar itſelf; whence compound Salts in which it is an ingredient are called by the name of Tartar, as vitriolated Tartar, tartarized Tartar, *&c.*

It is remarkable, that when four parts of powdered Tartar, and three of powdered Quick-lime are mixed together, and, and thoroughly calcined in a crucible, the product has neither ſmell nor taſte, and being thrown into water, lies unacted on, like a ſtone: On digeſting the maſs in water for a little time, it grows hot, and yields an exceeding ſtrong cauſtic alcali.

Its uſes. Tartar is uſed in medicine as a mild cooling purgative. Its principal conſumption is in the chemical arts, particularly dying, glaſs-making, metalurgy, in making Vinegar, Nitre, *&c.*

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and commonly but a ſmall one: The Cryſtals which ſeparate firſt from the liquor are little other than Cryſtals of Tartar; thoſe which ſucceed are more and more impregnated with the metal; the part which is fully ſaturated remaining diſſolved to the laſt. This property of Tartar ought to be well attended to, in the proceſſes of impregnating it with metallic bodies as particularly with the reguline part of Antimony, for medicinal uſe.

Borax, a Salt very difficult of ſolution by itſelf, has a remarkable effect on Tartar. Two ounces of Borax and four of Cryſtals of Tartar diſſolve, (without the efferveſcence which Tartar always excites with alcaline Salts and earths) in twelve ounces of water which is no more than about one ſixth part of the quantity that would be neceſſary to diſſolve them ſeparately. On evaporating the liquor, the ſalts concrete into an acidulous, viſcous, tenacious maſs, like Glue, which refuſes to cryſtallize, and which if exſiccated by heat, deliquiates again in the air.

In all theſe combinations of Tartar, its acid continues united with its groſs Oil and earth: Nor do we know of any method of extricating or ſeparating it from them, or of transferring it into any other body.

VINEGAR.

Vinegar. Its production.

VINEGAR is the produce of the ſecond ſtage of fermentation. If wines or vinous liquors be expoſed to a gentle continued warmth, the acetous fermentation ſpontaneouſly ſucceeds: A groſs tartareous and unctuous matter falls to the bottom; the inflammable ſpirit is reſolved or deſtroyed, and perhaps a part of it eſcapes; the liquor gradually loſes its conſiſtence, its ſweetneſs and its vinous flavour, and becomes a thin acid Vinegar. The acetous fermentation naturally follows the vinous, but is not neceſſarily preceded by it; Vinegar being producible without any intermediate ſtate of vinoſity:

Recovery from ſlight corruption.

When Vinegar has run a little beyond the acetous ſtate, and begun to enter on the putrefactive, it is ſtill in the power of art to recover it. The putrefaction may be ſtopt by quenching a red-hot Iron in the liquor; and the acid, which has been loſt or deſtroyed, may in ſome meaſure be reſtored, by the addition of a little Spirit of Wine, Rye-bread, Muſtard-ſeed, *&c.* The putrefaction of Vinegar is prevented in the ſame manner as the fretting or acetification of Wine by racking it off from the feculencies, and keeping it in a cloſe ſtopt veſſel in a cool place. Such as has once ſuffered a conſiderable heat, cannot long be preſerved from corruption.

Its principles.

Vinegar is compoſed of phlegm or water, the proper acetous acid, a groſſer acid approaching to that of Tartar, and an unctuous or oily matter. In diſtillation with a gentle fire, the phlegm and the acetous acid ariſe, with ſome of the finer parts of the Oil, the tartareous acid, and the groſſer Oil, remaining at the bottom. The Vinegars made from Malt-liquors contain more unctuous matter than thoſe from Wine, and give out their acid more difficultly. Vinegar ſeems to contain alſo a ſmall portion of the vinous ſpirit, that has not been changed or ſubdued by the fermentation.

Diſtillation of Vinegar.

The diſtillation of Vinegar in retorts, recommend-

VINEGAR. ed by ſome; is very troubleſome and incommodious. The beſt apparatus is a glaſs body or a pewter ſtill, fitted with a glaſs or ſtone-ware head. The compilers of the Brandenburgh Diſpenſatory have judiciouſly ordered the diſtillation to be performed in a water-bath, but ſubjoin a very needleſs caution of guarding againſt an empyreuma: The very advantage of the water-bath is, that we may ſafely draw over all that will ariſe, without danger, and even without a poſſibility of giving any empyreumatic taſte or ſmell to the ſpirit. The phlegmatic part which diſtils at firſt, may be thrown away; and the weaker acid, which comes over next, kept apart from the ſtronger acid that follows.

Further examination by fire. The matter remaining after the diſtillation, urged with a ſtronger fire in a retort, yields an empyreumatic Oil, and an extremely acid tartareous ſpirit, tainted with the burnt flavour of the Oil, from which it may be in good meaſure freed by repeated diſtillation. From the coal left in the bottom of the retort, may be obtained, by burning it in the open air, a fixed alcaline Salt more ſubtile and penetrating than the common alcalies. If Vinegar be drawn over from Quicklime, and the remaining maſs diſtilled in a retort, there ariſes a ſtrong volatile alcaline ſpirit, which acts notably on ſome metallic bodies. Thus is a part at leaſt of this acid liquor convertible by ſimple proceſſes into alcalies both fixed and volatile.

Preparations The ancients mixed Vinegar with different kinds of ſubſtances for medicinal uſe, and diſtinguiſhed the mixtures by different names expreſſive of the ingredients: Their *Oxycraton* or *Poſca* was compoſed of Vinegar and Water; *Oxelæum*, of Vinegar and Oil; *Oxalme*, of Vinegar and Salt-water; *Thymoxalme*, of Vinegar and Salt-water impregnated with Thyme: *Oxylepus*, of Vinegar and the *Cortex ſabarum*: *Oxyrrhodinum*, of Vinegar and Oil of Roſes or Roſe-water; *Oxyſaccharum*, of Vinegar and Sugar; and *Oxyglycu*, or *Oxymel*, of Vinegar and Honey. *Oxyſacchara* and *Oxymels* are ſtill retained in practice: They are prepared by diſſolving Sugar or Honey in a proper quancity of Vinegar, with or without the addition of other ingredients, and boiling down the mixture to the conſiſtence of a ſyrup: They are, in effect, no other than ſyrups, made with Vinegar inſtead of water.

Medicated Vinegars.

Medicated Vinegars are infuſions of different vegetable ſubſtances made in this acid liquor. If the Vinegar is digeſted with the herbs, flowers, &c. in a glaſs body or other convenient veſſel, with a gentle heat, it becomes impregnated with their virtues much more ſpeedily and effectually than by the expoſure to the ſun generally directed. Vinegar may likewiſe be medicated or flavoured by adding the ſubject to the Wine, or to the Muſt at firſt: There are many vegetables whoſe ſmell and taſte reſiſt both the vinous and acetous fermentation, and remain ſtrong in the Vinegar.

Vinegar as a menſtruum.

Vinegar diſſolves all the earths that the mineral acids diſſolve, and ſeveral of the metallic bodies. Lead is corroded by its vapour into Ceruſſe or white Lead: Ceruſſe, or the calces of Lead made by fire, diſſolve in Vinegar, and on inſpiſſation ſhoot into Cryſtals called *Saccharum ſaturni*. From Iron and Steel are prepared, by this acid, Chalybeate tinctures and extracts. Copper is corroded by it (or by the aceſcent preſſings of grapes) into Verdegris. See the ſeveral metals in the firſt part of this work (*y*). Saturated with

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(*y*) *Vinegar as a menſtruum for metallic bodies.*] This acid differs remarkably in its action on different metallic bodies, according as they are in their perfect metallic ſtate, or changed by fire or by other menſtrua, into the ſtate of a calx or crocus.

It diſſolves Zinc very eaſily, and Biſmuth more difficultly in both ſtates. It diſſolves Iron-filings very readily, but ſcarce has any action on the calces of Iron. Filings of Lead on the other hand are very difficultly acted on, but the calces diſſolve more eaſily: Vinegar boiled even with the glaſs of Lead, or in the common glazed earthen veſſels, in whoſe glazing this metal is a principal ingredient, extracts a notable quantity, ſo as to become ſtrongly impregnated with the pernicious qualities of the Lead, and to yield on evaporation a true *Saccharum ſaturni*. The antimonial Regulus alſo, both in the form of Glaſs and in its metallic ſtate gives a ſtrong impregnation to Vinegar, whilſt its calces, made by deflagration with Nitre, ſeem to be unaffected by it.

The habitude of Tin to the acetous acid has been diſputed. Our author finds, that this metal does not diſſolve in it; and on the other hand, with volatile alcalies, it forms a neutral ſaline liquor, which in diſtillation totally ariſes in a fluid form, without yielding any concrete Salt, as the combinations of the ſame alcalies with the mineral acids always do. Combined with fixed alcalies, it forms a ſubtile neutral ſalt, ſoluble both in Water and in Spirit of Wine, commonly called *Terra foliata* or *Arcanum tartari*: The ſame alcalies, combined with other acids into a neutral Salt, are not acted upon in the leaſt by vinous ſpirit——For this and other like purpoſes, diſtilled Vinegar is made choice of, not only as being ſtronger, but purer from Oil and groſs matter, than Vinegar undiſtilled.

Neutral Salt from Vinegar and alcali.

To prepare the *Terra foliata tartari* in perfection, requires ſome nicety. The alcaline Salt is diſſolved in Vinegar, the mixture ſet over the fire in a glaſs

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Mr. Marggraf affirms (in the Berlin Memoirs for the year 1747) that it diſſolves with eaſe. On trial I obſerved, that plates of pure Tin, put into common Vinegar, begun in a *few* hours to be corroded, without the application of heat: By degrees a portion of the metal was taken up by the acid, but did not ſeem to be perfectly diſſolved, the liquor appearing quite opake and turbid, and depoſiting great part of the corroded Tin, to the bottom in form of a whitiſh powder. A part of the Tin, if it is not truly diſſolved, is exquiſitely divided in the liquor; for after ſtanding for many days, and after paſſing through a filter, ſo much remained ſuſpended, as to give a whitiſhneſs and opacity to the fluid. Acid juices of fruits, ſubſtituted to Vinegar, exhibited the ſame phænomena. Theſe experiments are not fully concluſive for the real ſolubility of Tin in theſe acids, with regard to the purpoſes for which the chemiſts have wanted ſuch a ſolution; but they prove what is more important, that Tin or tinned veſſels, however pure the Tin be, will give a metalline impregnation to light vegetable acids ſuffered to ſtand in them for a few hours.

Gold, Platina, Silver, and Quick-ſilver, are not affected by Vinegar in their metallic ſtate; and theſe are the only metallic bodies that perfectly reſiſt it. Gold and Platina have not been obſerved in any ſtate to be affected by it: Silver precipitated from the nitrous acid and thoroughly edulcorated with water, and mercury treated in the ſame manner or changed by fire into a red powder, ſlowly and ſparingly diſſolve in it.

Of the affinities of this acid to different metals, or its forſaking one to unite with another, few experiments have been made. I have obſerved only, that it depoſites Lead and Copper, upon adding Iron. When Copper is diſſolved in Vinegar, though in ſo ſmall a proportion as ſcarcely ſenſibly to diſcover itſelf by the reputedly moſt rigid of all trials, ſtriking a blue colour with volatile alcalies; a poliſhed Iron laid in the liquor contracts a cupreous pellicle, in the ſame manner as from a ſolution of Vitriol of Copper. I have ſeen vegetable acids at table, give the firſt notice of their having received a pernicious impregnation from Copper veſſels, by leaving a copper-coloured ſtain upon the knife.

VINEGAR.

veſſel, and more and more Vinegar gradually added during the evaporation, till a freſh addition occaſions no further efferveſcence, and the vapour diſcovers an acid ſmell. The matter is ſtirred during the inſpiſſation till it begins to grow dry; when the fire, being raiſed a little, it aſſumes the foliated appearance from which it receives its name. The colour of the Salt is brown or blackiſh: If required white, it muſt be further purified, by ſolution in Spirit of Wine, or by gently and warily calcining it, then diſſolving it in water, and filtring and inſpiſſating the ſolution: If the Salt does not yet prove ſufficiently white, the calcination and ſolution in water are to be repeated. During this depuration, it is neceſſary to examine whether the Salt continues perfectly neutral: If it changes Syrup of Violets green, or a ſolution of green vitriol turbid, we may be ſure that the alcali prevails; in which caſe ſome more diſtilled Vinegar muſt be added. There is no danger of exceeding in the quantity of acid: For though an over proportion of this has been uſed, whatever there is more than ſufficient to neutralize the alcali will be diſſipated in the calcination.

Concentrated.

In the *Terra foliata*, *Saccharum ſaturni* and Verdigris, the pure acetous acid is retained, without much phlegm. On diſtilling theſe concretes in a retort, a ſtronger and more concentrated acid ſpirit ariſes, than can be obtained by diſtilling Vinegar by itſelf: This is called *Acetum concentratum* and *radicatum*. Vinegar may be concentrated alſo to a great degree by congelation, the aqueous part freezing, whilſt the acid remains fluid (z). The highly concentrated ſpirit

Dulcified.

may

(z) *Concentration of Vinegar.*] The concentration of Vinegar by freezing ſucceeds better than that of Wines or vinous liquors. We have formerly ſeen that thoſe liquors, whilſt their watery part freezes, ſuffer a notable alteration in their other principles: The acid of Vinegar is not hurt by the freezing of its phlegm.

By the operations above propoſed, the acetous acid may be concentrated to a degree of ſtrength, in regard to acidity, greater than even the mineral acid ſpirit of Sea-ſalt can eaſily be brought to. It ſtill however retains its ſpecific properties, and continues as different from any of the mineral acids, as they from one another. Its peculiar taſte and odour, VINEGAR

may be dulcified, like the mineral acids, by digeſtion and diſtillation with equal or twice its quantity of rectified Spirit of Wine.

Method of eſtimating its ſtrength.

The degree of ſtrength or acidity of Vinegar may be determined, as that of other acids, by neutralizing it with fixed alcaline Salt, and exſiccating the compound: As the alcali retains only the acid part, the increaſe which it has now gained in its weight will give the quantity of acid contained in the Vingar. In the following experiments, eight drams, or 480 grains of each of the Vinegars were employed.

Table of the ſtrength of different Vinegars.

	Saturated of fixed alcali.	Weight of the neutral Salt.	Hence the quantity of Acid.	Phlegm.
	Grains.	*Grains.*	*Grains.*	*Grains.*
Spirit of Pale-beer Vinegar	16	24	8	472
Spirit of Brown-beer Vinegar	16	24	8	472
Spirit of Wine Vinegar -	26	38	12	468
Spirit of Verdegris - -	72	120	48	432
Concentrated Vinegar -	270	437	167	313

CLASS II.

Products from Vegetables by Fire.

BY FIRE.

THE effect of fire upon vegetable ſubſtances differs greatly, according as the air is excluded or admitted. On diſtillation in cloſe veſſels, all ve-

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odour, its refuſing to chryſtallize with volatile alcalies, its forming with fixed ones a neutral Salt which deliquiates in the air and diſſolves in Spirit of Wine, its parting from the fixed alcalie in a moderate fire without any addition, and in ſome degree volatilizing the alcali, its being expelled from alcalies, earths and metals by all the mineral acids, its effects on ſome of the metallic bodies, are ſtriking characters of the acetous acid in all its ſtates of ſtrength.

Some have been accuſtomed to increaſe the acidity of weak Vinegar, by the addition of a certain proportion of the acid of Vitriol. The acid of Vitriol is ſo different, in its effects upon many bodies, from that of Vinegar, that a moſt minute proportion of it is very readily diſcovered. Drop into the liquor a little ſolution of Chalk made in Aqua fortis or Spirit of Salt: If the Vinegar was pure, no change will enſue; if it contained any vitriolic acid, the mixture will become milky in proportion to the quantity of that acid; the vitriolic acid uniting with the diſſolved Chalk into a compound no longer diſſoluble, and which on ſtanding ſubſides in form of a ſelenitic powder.

By Fire.

getables give over an Oil, not ſuch as it exiſted in the original ſubject, but highly fitted and empyreumatic. Previous to the Oil ariſes a portion of phlegm, and from moſt vegetables an acidulous, from ſome a volatile alcaline ſpirit, tainted with the burnt taſte and ſmell of the Oil. In the bottom of the diſtilling veſſel remains a black coal, which ſo long as the air is excluded, ſuffers no further alteration or diminution in the moſt intenſe fire, but on admitting the air burns into white aſhes with a notable decreaſe of its weight (*a*).

Vege-

(*a*) *Coal, not alterable without air.*] Upon this principle, the method of making charcoal depends. A quantity of wood cut in pieces, is piled in a large heap, which is ſet on fire and lightly covered with Turf, to prevent its burning too violently. When the ſmoke is diſſipated, and the wood reduced into a clear, red hot coal, the whole is immediately covered cloſely over with earth, which, by excluding the external air, prevents the coals from being any farther conſumed. When the proceſs is ſkillfully managed, the coals exactly retain the figure of the pieces of wood: Some have been ſo dextrous as to char an arrow, without altering the form even of the feather——Pit-coal alſo is for ſome purpoſes advantageouſly charred, as for the drying of Malt, and the ſmelting of metals; the fuliginous and ſulphureous parts which would give a taint to the one and brittleneſs to the other, being thus diſſipated, whilſt the more pure and fixed igneſcible matter is left.

There are conſiderable differences in the coals of different vegetables, in regard to their habitude to fire. The very light coals of Linen, Cotton, ſome Fungi, *&c.* readily catch fire from a ſpark, and ſoon burn out; The more denſe ones of woods and roots are ſet on fire more difficultly, and burn more ſlowly. The coals of the black berry-bearing Alder, of the Hazel, the Willow, and the Lime-tree, are ſaid to anſwer beſt for making of Gunpowder and other pyrotechnical compoſitions; perhaps from their being eaſily inflammable. For the reduction of metallic calces, thoſe of the heavier woods, as the Oak and the Beech, are preferable; theſe ſeeming to contain a larger proportion of the phlogiſtic principle, and that perhaps in a more fixed ſtate. Conſidered as common fuel, thoſe of the heavy woods give the greateſt heat, and require the moſt plentiful ſupply of air to keep them burning: Thoſe of the light woods preſerve a glowing heat, without much draught of air, till the coals themſelves are conſumed: The bark commonly crackles and flies about in burning, which the coal of the wood itſelf very ſeldom does.

Coals are indiſpoſed to putrefy: Hence the ends of wooden poſts, to be fixed in the earth, are charred on the outſide to preſerve them from rotting. Neither water, vinous ſpirits, Oils, acid or alcaline liquors, diſſolve or extract any tincture from them. In burning, they are ſuppoſed to emit a peculiar vapour, which, confined and accumulated in a cloſe room, proves poiſonous to animals: there are indeed too many examples of fatal conſequences from the burning of Charcoal in cloſe places, not however from the Charcoal giving out any pernicious matter,

but

By Fire.

Vegetables burnt at firſt in the open air, emit a copious ſmoke, which is manifeſtly impregnated with an acid, and of which a conſiderable part may be collected and condenſed into a black Soot. The aſhes which remain give out to water a portion of fixed alcaline Salt; thoſe vegetables excepted which yield any conſiderable quantity of volatile alcali in the diſtillation, for the aſhes of theſe ſcarcely afford any fixed Salt.

Into theſe principles all vegetables and their parts, and all the ſubſtances extracted from vegetables, are reſoluble; but with ſome differences in regard to the quantities. Thus Gums and Mucilages yield very little Oil, but Reſins abundance; from Gums, Mucilages, Reſins and Oils we obtain very little alcaline Salt; but from the acid eſſential Salts, as that of Sorrel, a large proportion.

EMPYREUMATIC OILS.

Emp. Oils.

Diſtillation of empyreumatic Oils.

THE diſtillation of empyreumatic Oils is performed in earthen retorts or long-necks, or in coated glaſs ones. The fire muſt be ſtrong, but ſlowly raiſed: and the juncture of the retort and recipient but ſlightly luted. Vegetable ſubſtances in general, urged haſtily by a ſtrong fire, emit an aereal elaſtic vapour, which, if no exit is allowed it, throws off or burſts the receiver: Reſinous ſubſtances ſwell and boil up in the fire: It is cuſtomary to mix with theſe a quantity of Sand or other earthy matters to prevent their boiling over, though by carefully regulating the heat, the diſtillation may be commodiouſly performed without any ſuch addition. The Oil which ariſes at firſt is commonly fluid, and ſwims upon the phlegm and ſpirit that preceded it: That which follows proves more and more thick and heavy, and ſuch as is forced out at laſt by the greateſt vehemence of fire aſſumes a pitchy conſiſtence.

but from the quality of the air of the room being altered by the fire. Air that has paſſed through burning fuel is no longer capable of ſupporting either fire or the life of animals.

The

Their general properties, and differences from eſſential Oils.

The Oils obtained from vegetables by this proceſs differ remarkably from the eſſential ones diſtilled with water. Even after their ſeparation from the ſubject, they do not ariſe in the heat of boiling water, or at moſt only the finer and more ſubtile parts are elevated by that heat. They have a very diſagreeable burnt ſmell and taſte, and a great degree of acrimony, without any thing of the peculiar flavour or other qualities of the vegetable they were drawn from. The moſt inodorous and inſipid expreſſed Oils, as Oil Olive and Oil of Almonds, diſtilled by a ſtrong fire, become in like manner fetid and acrimonious; and eſſential Oils themſelves, by a like treatment, loſe their ſpecific flavours, and contract an empyreumatic taint.

Empyreumatic Oils diſſolve in Spirit of Wine rather more eaſily than the eſſential (b); they are likewiſe more

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(b) *Solubility of Oils in Spirit of Wine.*] It is obſervable, that the eſſential Oils obtained from different vegetable matters, diſſolve with different degrees of facility in Spirit of Wine. That all of them, as firſt diſtilled, diſſolve more eaſily than after they have been rectified; and that on every rectification, or rediſtillation, they become leſs and leſs diſſoluble, whilſt the reſinous reſiduum diſſolves more eaſily than the Oil at firſt. Expreſſed Oils, on the other hand, in their natural ſtate, are not ſoluble in vinous ſpirits at all: Diſtilled, or rendered empyreumatic by fire, they acquire a degreee of ſolubility; and on repeated diſtillations they become eaſier and eaſier of ſolution. Theſe Oils are likewiſe made ſoluble in ſpirit, by being combined with alcaline Salts into Sope, and afterwards ſeparated from the alcali by the addition of any acid.

Mr. Macquer, in the French Memoirs for the year 1745, endeavours to account for theſe different phænomena—Spirit of Wine, as we have formerly ſeen, conſiſts of a ſubtile attenuated Oil combined with water: It contains alſo an acid principle, and poſſibly it is by means of this acid that the Oil is combined with the water. The ſoluble eſſential Oils are found to participate of an acid; and the admixture of Oil of Vitriol or Spirit of Nitre renders thoſe Oils ſoluble in ſpirit which of themſelves are not. Mr. Macquer is hence led to ſuppoſe, that Oils are more or leſs ſoluble, in proportion as they contain more or leſs of a manifeſt acid. Eſſential Oils, rectified, become leſs ſoluble by loſing a part of their acid; and the reſiduum proves more ſoluble, by retaining the acid which the Oil has loſt. Expreſſed Oils are indiſſoluble, becauſe their acid is latent, or too intimately combined with the other principles to exert its activity: Fire makes them ſoluble, and more and more ſo, by extricating this acid, and by extricating more and more of it in every diſtillation: Alcalies alſo call forth their latent acid and on adding to this compound any other acid, the Oil with its acid ſeparates (in the ſame manner as Sulphur diſſolved in alcalies) and of courſe diſſolves in Spirit. The ſame theory is apmore diſpoſed to unite with water, probably from their participating more of an acid principle. By careful rediſtillations they become more ſubtile and volatile, and loſe much of their fetid ſmell, a large proportion of groſs matter being left behind: I have rectified an empyreumatic Oil to ſuch a degree, that one could not eaſily determine what kind of ſubſtance it was: It mingled with almoſt all ſorts of liquors, with expreſſed Oils, diſtilled Oils, Spirit of Wine, Vinegar, and Water.

Rectification.

The rectification of theſe Oils is uſually performed with the addition of Aſhes, burnt Hartſhorn, Quick-lime, fixt alcaline Salts, and other ſubſtances, which are ſuppoſed to make the purification more perfect by detaining the groſſer matter. There is no occaſion for any aſſiſtances of this kind: It is ſufficient to waſh the Oil with warm water, put it into a retort with freſh water, diſtil by a gradual fire till the fluid part is come over, and repeat the ſame proceſs with the Oil that diſtils: Every repetition renders it more and more ſubtile, and proportionably diminiſhes its quantity. The water, which ariſes before the Oil, is impregnated with a part of it—When fixed alcaline Salts are employed in the rectification, a portion of volatile alcali is generated: When Quick-lime or

applied alſo to reſinous ſubſtances, for all Reſins yield a little acid in diſtillation: Where he finds a Reſin that diſſolves eaſily in Spirit of Wine, its acid is manifeſt or but looſely combined: In thoſe which diſſolve difficultly, the acid is latent, or enveloped in the other matter.

This theory is plauſible and ingenious, but a competency of experiments is as yet wanting to enable us to determine how far it is juſt. There is wanting, for inſtance, ſome direct evidence, that an acid is really extricated from expreſſed Oils, by making them into Sope, or by fire; for the filaments of the torn edges of blue paper being ſtained of a reddiſh yellow colour by the fumes of boiling Oil, can ſcarcely be depended on as a teſt of acidity. There is wanting more particularly ſome proof that theſe oils are capable of being made diſſoluble in ſpirit by the admixture of any vegetable acid; for their being ſo by the concentrated mineral acids, does not ſeem to be ſufficient, eſpecially as theſe acids, at the ſame time as they render the Oil diſſoluble, changes its nature, and convert it into a ſubſtance of a different kind. It ſeems hard to admit that animal Oils contain an acid; and yet theſe Oils diſſolve as well as the vegetable in Spirit of Wine.

calcined Hartſhorn, the Oil, by repeated diſtillations, is totally deſtroyed.

SOOT.

Its differences from vegetables entire, and from their ſmoke.

THOUGH the ſmoke of wood is apparently acid, the Soot is no acidity: Inſtead of yielding an acid in diſtillation, as wood itſelf does, it yields a volatile alcali; together with an empyreumatic Oil like that obtained from vegetables entire. Oils themſelves, whether empyreumatic, eſſential, or expreſſed, afford a Soot in burning; and this ſoot is reſoluble into the ſame principles as that of wood. The coal remaining after the diſtillation of Soot burns into white aſhes, from which may be obtained a fixt alcaline Salt, as from other vegetable aſhes. Some of the chemiſts have ranked Oil as one of the elementary parts of bodies; but it cannot ſurely be looked upon as an element, when it is convertible or reſoluble into an aqueous or acid vapour and Soot, and this Soot further reſoluble into Water, Oil, volatile Alcali, fixed Alcali and Earth.

Differences in Soots.

The Soots produced from different vegetable ſubſtances, from green and dry ones, from open and more confined fires, differ in regard to the proportion, but not in the quality, of the principles they afford.

Analyſis by fire.

Sixteen ounces of the common Wood-ſoot of Berlin yielded a dram of volatile alcaline Salt, ſeven drams of Oil, and a dram and a half of fixed Alcali: The ſame quantity of French Wood-ſoot gave upwards of two ounces of Oil, a dram of volatile Alcali, and four drams of fixed. The volatile Salt is very difficultly purified from the fetid Oil, more ſo than thoſe of animal ſubſtances. It is ſaid that the Oil, rectified with Hartſhorn or Vinegar, acquires a ſmell like that of Camphor; but I have not been able, on careful trial, to perceive any ſuch ſmell. It is obſervable that a mixture of Soot and Salt of Tartar, digeſted for ſome months with the juice of the Birch-tree, that is, the liquor which iſſues upon boring the tree early in the ſpring, yields on

being

SOOT. being diſtilled a liquor of a beautiful, but not very durable purpliſh-red colour: With common water no ſuch colour is produced.

Analyſis by menſtrua. The bitter matter of Soot, and that part in which its ſmell reſides, are diſſolved and extracted both by watery and by ſpirituous menſtrua. On digeſting ſixteen ounces of Soot in rectified Spirit of Wine, and evaporating the tincture, the dry extract amounted to four ounces: The ſame quantity, treated in the ſame manner with water, yielded juſt as much. The Soot remaining after the action of either of theſe menſtrua, yields with the other about two ounces and five drams.

Soot is employed ſometimes medicinally as an antihyſteric, *&c.* and in operations on ſome metallic bodies. It is to the action of a ſooty flame, that the red colour of Minium is owing: From a ſooty flame, the ruby and ſome other glaſſes receive their colour. The finer parts, ſeparated by means of water, are uſed as a Pigment, under the name of Biſtre. Boiled with woollen cloth, it communicates a brown dye, and in this intention is ſometimes employed by the dyers. The ſubſtance called Lamp-black is no other than a vegetable Soot, produced in the burning of Reſins.

FIXT ALCALINE SALTS.

FIXT ALCALI. Preparation of fixt alcalies. FIXT alcaline Salts, called alſo Lixivial ſalts, are extracted from the aſhes of vegetables, by macerating or boiling them in water, ſtraining or filtering the Ley, and evaporating it till the Salt remains dry. If the aſhes have not been thoroughly burnt, the Salt appears brown coloured and foul: By calcination, and rediſſolution it becomes pure and white (*c*). If the ſolution be evaporated only till

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(*c*) *Preparation of fixed Alcalies.*] The moſt commodious method of preparing fixed alcaline Salts in the large way ſeems to be that directed by Kunckel in his Art of Glaſs. The aſhes of wood or the woody parts of vegetables, either burnt on purpoſe or as common fuel, are to be

Fixt Alcali.

till a pellicle begins to concrete upon the ſurface; then put into a glaſs body, covered ſo as to prevent the

be put into a large tub or vat, whoſe bottom is covered with pieces of ſplit wood and ſtraw to prevent the aſhes from ſtopping up the cock. So much water is to be poured on the aſhes as may totally cover them. After ſtanding for a night, the liquor, impregnated with their ſaline part, is to be let off by the cock at the bottom into another veſſel; and the elixation repeated with freſh water ſo long as the Ley has any ſaline taſte. The elixated aſhes may be uſed, like common wood aſhes, for manure; and the weak Leys may be rendered ſtronger, by pouring them, inſtead of plain water, upon a freſh quantity of aſhes. Thus from every parcel of aſhes we obtain a ſtrong Ley, with a weaker one to be returned on the next. Where the Ley is to be kept in its liquid ſtate, wooden veſſels (according to him) are more commodious than earthen ones however glazed; theſe laſt being ſoon corroded and penetrated by the acrid liquor.

For procuring a ſolid Salt, the Ley is to be evaporated in an iron pan fixed in brick-work; freſh Ley being continually ſupplied during the evaporation, in a very ſlender ſtream, from a caſk placed on the brick-work, till the quantity of Salt is as large as can be conveniently dried in the veſſel. This impure brown or blackiſh Salt is to be calcined, in a furnace built for that uſe, with a red heat juſt not ſtrong enough to melt it, and every now and then turned up and ſtirred, for ſix or ſeven hours, or till ſome of the larger pieces, taken out and broke, appear internally white. Thus we obtain an Alcali ſufficiently pure for all the buſineſſes in which theſe kinds of Salts are employed: If for particular purpoſes a further purification ſhould be required, it may be diſſolved, inſpiſſated, and calcined afreſh. The rough Salt loſes, in the firſt calcination, commonly about one tenth of its weight.

Some ſoak in the Ley a quantity of Straw, Bean-ſtalks or other like ſubſtances, ſufficient to imbibe it; and by drying, and burning theſe, obtain the Salt of the Ley, without the trouble of boiling it down. The earthy matter left by the Straw is, in quantity inconſiderable, and for many purpoſes, of no injury to the Salt, particularly for ſope boiling, bleaching, &c. where the Salt is diſſolved, and conſequently purified from indiſſoluble earthy admixtures, before it is uſed. There is nevertheleſs one great inconvenience in the proceſs; the Straw, when loaded with the Alcali, being very difficultly made to burn. Vegetable ſubſtances in general, when fully impregnated with fixed alcaline Salts, never flame; and do not burn at all without a continuance of external heat; inſomuch that ſome have propoſed the impregnating of wood, for buildings, with Salts, as an effectual means for preventing its receiving or communicating fire.

The ſtrength of Leys, or the quantity of Salt diſſolved in them, may be eſtimated by the weight of a certain meaſure of them, compared to the weight of an equal meaſure of water; or more commodiouſly, and perhaps as accurately, by means of an hydrometer graduated from actual trials with Leys of known ſtrength.

I have made ſeveral experiments for determining the ratio in which alcaline Salts increaſe the gravity of water; with a view to enable the workman to judge with ſome preciſion, from the weight of the Ley, the quantity of Salt that may be expected from it on evaporation. I diſſolved in pure water different proportions of fixed alcaline Salt, and weighed

Fixt Alcali.

the falling in of duſt, and ſet by in a moderately warm place, part of the Salt will ſhoot into cryſtals; and if the remaining liquor be further evaporated to a pellicle, and ſet by as before, more cryſtals will be obtained. Some have held theſe cryſtallized Salts to be more pure than ſuch as are directly inſpiſſated to dryneſs: But in reality they are more impure; fixed alcalies never aſſuming a cryſtalline form, but in proportion as they participate of an acid. If a perfect Alcali is required, we ſhould reject the cryſtals, and employ only the Salt procured by inſpiſſation from the liquor remaining after the cryſtallization.

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very carefully equal meaſures of the ſeveral ſolutions, in a narrow-necked glaſs, which held ſixteen ounces of water: A mark was made in the neck with a diamond at the part where this quantity of water aroſe to, and the bottle filled to the ſame height with each of the other liquors. The reſult of the experiments was as follows.

When 16 ounces of the liquor, by weight, contained of Salt.		The measure of the liquor weighed more than 16 ounces, or more than an equal meaſure of water, by		
Oz.	*Dr.*	*Oz.*	*Dr.*	*Gr.*
0	4	0	1	40
1	0	0	3	30
1	4	0	5	00
2	0	0	7	30
2	4	1	1	30
3	0	1	3	30
3	4	1	5	00
4	0	1	7	20
4	4	2	1	22
5	0	2	3	25
5	4	2	5	02
6	0	2	7	30
6	4	3	1	30
7	0	3	3	28
7	4	3	5	01
8	0	3	7	30
8	4	4	1	30

The weights here made uſe of were the Troy, of ſixty grains in the dram, and eight drams in the ounce.

* Theſe experiments agree very nearly in the ſame ratio. We may draw from them this general rule, that the weight, by which any meaſure of Ley exceeds the ſame meaſure of water, is ſomewhat leſs than one half (or about five twelfths) of the quantity of Salt contained in a meaſure of the Ley.

FIXT ALCALI.

Different ſorts. Soda.

POT-ASH.

Fixt alcaline Salts were originally prepared from the aſhes of the plant Kali, and from hence they are ſuppoſed to have received their name. Kali or Soda is a maritime plant; and its aſhes contain, beſides the truly alcaline Salt, a portion of Sea-ſalt (*d*). It has been found that fixed alcalies are conſtantly the ſame, whatever ſubject they have been produced from: Hence at preſent, they are made chiefly from ſuch ſubjects as are moſt plentiful, and afford them in greateſt purity and in greateſt quantity. A Salt is ſtill indeed in ſome places prepared from Kali; and employed by the glaſs makers, dyers and ſope-boilers; but thoſe commonly met with in the ſhops, under the name of Pot-aſh, are obtained from the aſhes of different kinds of woods, particularly the hard ones: They are made chiefly in the woody countries, Muſcovy, Poland, Courland, &c.

(*d*) *Soda*] Soda, the impure Salt of Kali or Glaſswort, ſometimes brought to us from Spain, appears to contain no actual marine Salt, or only an inconſiderable proportion. The ſaline part, however, when purified from the earthy matter which is uſually in large quantity, approaches in ſome reſpects to the nature of that Salt, and differs remarkably from all the other known vegetable alcalies.

On gently evaporating ſolutions of it, the Salt concretes into cryſtalline maſſes, which do not liquefy, nor ſoon grow moiſt in the air. The cryſtals change Syrup of Violets green, render Sulphur and Oils ſoluble in water, effervesce with all acids, precipitate earthy and metallic bodies diſſolved in them, and unite with the acid into a neutral Salt; proofs, that notwithſtanding their cryſtalline appearance, they are truly alcaline.

When this Alcali is combined with the acetous acid, the neutral compound is found to be nearly ſimilar to that compoſed of the ſame acid and the common alcalies: but in combination with the mineral acids, the caſe is different. With the vitriolic it forms, not like other alcalies a vitriolated Tartar, but a Sal mirabile; with the nitrous, not common Nitre, but a Nitre which cryſtallizes into cubes; with the marine, a perfect Sea-ſalt; proofs, that the Alcali of Soda is the ſame with the alcaline baſis of Sea-ſalt, but wants its acid. (See the reſpective Salts in the firſt part).

The Kali itſelf appears to contain actual Sea-ſalt. Stahl informs us, that its taſte is manifeſtly brackiſh, and that in ſome places it is uſed inſtead of common Salt. Henckel, in the Appendix to his *Flora Saturnizans*, gives a more convincing proof: By boiling the herb in water, and evaporating and cryſtallizing the decoction, he obtained a true marine Salt, and in conſiderable quantity.

The laſt mention author diſcovered a pretty remarkable phænomenon in treating both the Spaniſh Soda, and the Salt, elixated from the aſhes of the German jointed Kali, with the mineral acids. On ſaturating

either

FIXT ALCALI.

The common Pot-aſh is not a pure alcaline Salt, any more than the Salt of Soda. It contains a conſiderable portion of mere earth, ſeparable by diſſolving the Salt in water (*e*). It contains alſo a neutral Salt,

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either of theſe Salts with any of the acids, a deep blue powder fell to the bottom, ſimilar to Pruſſian blue, and which anſwered equally in painting. He obſerves, that the quantity of this powder is very ſmall, amounting only to about five grains from an ounce of the Salt; and that it is largeſt when the vitriolic acid is uſed: That with diſtilled Vinegar there was no precipitation; with dulcified Spirit of Nitre, only a browniſh one.

The Spaniſh Soda was formely in great requeſt for making Glaſs, Kunckel obſerves, that when duly purified, it proves for that purpoſe equal, but not ſuperior to other alcaline Salts; that Glaſs made with Soda in the impure ſtate in which it is brought over, is exceeding apt to crack or fly in cooling, and has likewiſe a bluiſh caſt, which, if we endeavour to clear it by the addition of Manganeſe, changes to a blackiſh or a greeniſh—Stahl on the other hand, gives the preference to Soda. He admits that Pot-aſh yields a finer Glaſs; but ſays the Glaſs prepared with Pot-aſh has this capital defect, that if it has not been kept in the fire till the Salt is burnt *dead* as he calls it, veſſels made of it crack after they have been wetted, and large pieces fly out of them; the unmortified or unconſumed Salt beginning to diſſolve, ſo as to deſtroy the coheſion of the Glaſs. We apprehend that this imperfection proceeds rather from a redundance in the quantity, than from any particular quality of the Salt made uſe of.

(*e*) *Pot-aſh.*] There are two principal ſorts of theſe Salts brought chiefly from Germany, Pearl-aſh, and Pot-aſh. The Pearl-aſh is either of the whitiſh Pearl colour from which it receives its name, or externally of a bluiſh caſt, which theſe kinds of Salts are apt to receive in calcination from the contact of any inflammable matter. Both the Pearl-aſhes are tolerably pure alcalies: Diſſolved in water, or deliquiated in the air, they leave only a ſmall quantity of earthy matter, ſcarcely more than every alcaline Salt does upon repeated ſolutions and calcinations. They are ſometimes, however, adulterated with heterogeneous ſaline matters, particularly Sea-ſalt. The purity of Pearl-aſh from ſubſtances of the earthy kind points out the method in which it has been prepared, namely, evaporating a Ley of vegetable aſhes till the Salt remains dry.

Pot-aſh is a much more impure ſaline maſs: That called Ruſſia or Muſcovy Pot-aſh is accounted the beſt. This is of a dark colour, conſiderably hard, and does not eaſily grow moiſt in the air: On boiling it in water, a quantity of earth remains undiſſolved, much larger than that of the Salt which is extracted, It is nevertheleſs found to be ſtrongly alcaline, to be more pungent to the taſte, to ſaturate more acid, and more powerfully to diſſolve Oils, than the pureſt alcaline Salts: Hence it is preferred by the Sope-boiler.

This Salt is ſaid to be prepared, by burning wood with a cloſe ſmothering heat; making a Ley from the coarſer part of the aſhes, and moiſtening therewith the finer part into the conſiſtence of a paſte, ſtratifying this paſte with ſome of the more inflammable kinds of wood, and ſetting the pile on fire—It is not improbable, that the ſaline and earthy part of the aſhes would thus run together into hard lumps; but a maſs poſſeſſing the activity of Ruſſia Pot-aſh is not to be obtained by any proceſs

of

FIXT ALCALI.

Contain a neutral Salt.

whoſe acid is manifeſtly the vitriolic, for on being melted with powdered Charcoal, it produces a true Sulphur. Did this acid exiſt originally in the wood? Was it communicated, during the burning, by the air, whoſe paſſage through the fuel is abſolutely neceſſary to the ſupport of fire, and of which immenſe quantities muſt be conſumed by the large piles uſually burnt at once for the making of Pot-aſh? Or was it imbibed from the water employed for the elixation of the Salt? Perhaps it may proceed in part from all the three ſources.

Purification.

The neutral Salt in Pot-aſh, whatever be its origin, is ſimilar in its properties to vitriolated Tartar. It is ſcarcely acted upon by cold water, diſſolves difficultly in hot water, and in great part ſeparates again as the ſolution cools. Hence the alcaline Salt may be purified from the neutral, by ſolution in hot water, and after evaporation to a pellicle, ſetting the liquor to ſhoot; or more effectually, by employing cold water, which will diſſolve the alcaline, and leave the neutral Salt behind. The purification will ſtill be more perfect, if the inſpiſſated Salt be run per deliquium, for no part of the neutral Salt will deliquiate in the air.

Differences in the common alcalies.

It is owing to the admixture of this vitriolic or other neutral Salts, or to a part of the inflammable or oily principle of the ſubject being retained in the Salt, from the aſhes not having been perfectly burnt; that different alcaline Salts, exhibit in ſome experiments, different phænomena. Hoffmann obſerves, that when Oil of Vitriol is poured upon Salt of Tartar, the liquor acquires a blackiſh ſkin on the ſurface, appears itſelf alſo blackiſh, and emits a particular fetid ſmell; but that nothing of this happens when Pot-aſh is uſed; that Salt of Tartar, melted with ſand, does not form a clear and tranſparent Glaſs, which Pot-aſh does; and that Salt of Tartar gives a tincture to highly rectified Spirit of Wine, which Pot-aſh does not. Theſe

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of this kind. For the diſcovery of the ingredient on which that quality depends, we are obliged to Dr. Home, who, in his eſſay on bleaching, has proved, by a number of curious experiments, that Ruſſia Pot-aſh contains a large admixture of Quick-lime.

FIXT ALCALIES. experiments prove, not that the two Salts differ from one another as alcalies, but that one retains a part of the Oil of the ſubject, and the other not. When Tartar is deflagrated with a due proportion of Nitre, its Oil is wholly burnt out, and the alcaline Salt thus obtained, equally with Pot-aſh, forms a clear Glaſs with ſand, produces no blackneſs with Oil of Vitriol, and gives no tincture to rectified ſpirit. The ſame author finds however that there is now another difference; that Pot-aſh, and the Salt made from Tartar alone, on being melted with Charcoal powder, form a ſulphureous compound, whilſt the Salt from Tartar and Nitre has no ſuch effect: The cauſe is obviouſly this, that the two former contain a portion of the vitriolic Salt above-mentioned, and the latter not.

All ſimilar when pure. In ſhort all the alcaline Salts, when perfectly pure, are one and the ſame thing: From one vegetable we obtain Salts as different, according as the aſhes have been more or leſs calcined, elixated with hot or with cold, with a large or a ſmall quantity of water, *&c.* as we do from different ones; the differences obſerved in the Salts, when any differences are obſerved in them, depending upon the manner in which the proceſs has been managed, and not upon the qualities of the ſubject. No art can diſtinguiſh the fixt alcaline Salts of the ſweet plants from thoſe of the bitter or the ſour; of the purgative from the aſtringent; of the higheſt cordials and aromatics from thoſe of the moſt deadly poiſons (*f*).

Fixt

(*f*) *Idenity of fixed alcaline Salts.*] In regard to this point, fixed alcaline Salts are to be conſidered in two ſtates; that in which they are prepared by the workman for common uſes, by incinerating the plant, elixating the Salt from the aſhes, and evaporating the Ley; and that of their ultimate purity, obtained by repeated calcinations with a ſtrong fire, and deliquiations in the air. In this laſt ſtate, all fixed alcaline Salts (the marine alcali excepted) are perhaps one and the ſame thing; at leaſt the experiments hitherto made diſcover no diverſity in them. But in the firſt ſtate, the Salts of different plants exhibit, on ſundry trials, differences too conſiderable to be overlooked by the artiſt or by the philoſopher.

Mr. Gmelin has given a great number of experiments on this ſubject in the fifth volume of the *Commentarii Petropolitana*. The Salts of the ſeveral plants examined were prepared with great care, and all of them exactly in the ſame manner, each vegetable being burnt, in a ſeparate crucible, with the ſame degree of fire, till no remains of coaly matter could

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FIXT ALCALI.
Their production.

Fixt alcaline Salts ſeem to be produced from a combination of the groſſer acid and a part of the earth of the ſubject, and perhaps a little of the more fixed inflammable principle, effected by the fire. The eſſential Salt of Sorrel is a truly acid Salt, totally ſoluble in Water. An ounce of this Salt, diſtilled in a glaſs retort, gave over about a ſcruple of Oil, and three drams of phlegm ſlightly impregnated with a volatile acid, certainly not all the acid that the Salt contained: The reſiduum weighed four drams twenty grains, and from this were obtained three drams of perfect alcaline Salt. If fixed alcalies be calcined, deliquiated in the air, the liquor inſpiſſated, and the deliquiation and inſpiſſation ſeveral times repeated, a quantity of earthy matter will ſeparate every time, till at length nothing but earth is left. The perfect inſpiſſation, however, cannot be continued long: After a number of repetitions, the liquor cannot be reduced to a dry ſtate, but retains nearly the conſiſtence of Oil of Vitriol: Expoſed to the fire in a crucible, it diſſolves or penetrates it.

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any longer be perceived; and the aſhes elixated in glaſs veſſels, with cold diſtilled water. The Salts, thus obtained, were found to produce different colours on mixture with certain liquors, and to efferveſce in very different degrees with acids: Certain metallic ſolutions were by ſome precipitated, by others only rendered thick, by others both precipitated and thickened, whilſt others occaſioned neither one or the other of theſe changes, and left the liquor fluid and tranſparent. Thus, with the vitriolic acid, the Salts of Southernwood and Sage ſtruck a pale brown colour; thoſe of Pine-tops and Rue, a yellow; that of Fern, a reddiſh-yellow; and that of Sanicle, a dark Leek green: That of Dill yielded a Leek green Precipitate, with elegant green flakes floating in the liquor. This laſt Salt gave a greeniſh Precipitate alſo with the marine acid, and a red one with the nitrous. Solution of corroſive Sublimate was changed yellow by Salt of Southernwood; of a browniſh Saffron colour by that of Colts foot; of a deep red by that of Wormwood; and of a Pitch colour by that of Dill: That of Fern threw down an opal coloured, of Sage a Sulphur yellow, of Elder-flowers a Citron yellow, of Sanicle a Saffron coloured, and of Milfoil a deep red Precipitate. From ſolution of Silver, Salt of Carduus benedictus threw down a white, of Camomile a grey, of Hyſſop a browniſh, of Dill a blackiſh-brown, of Scabious a yellowiſh, and that of Pine-tree tops a Sulphur yellow Precipitate. Solution of Vitriol of Copper was changed by Salt of Southernwood to a bright ſea-green, by that of Dill to an unſightly green, of Agrimony to a greeniſh-blue, and by that of Milfoil to a bright ſky-blue: The Salt of Pennyroyal made the liquor thick as well as blue, and that of Feverfew made it thick and green: The Salt of Hyſſop threw down a green Precipitate; that of Scurvy-graſs a blue one, and that of Fumitory a greeniſh blue; whilſt the Salt of Fern made ſcarcely any change either in the colour or conſiſtency of the liquor.

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Vegetable ſubſtances which abound moſt with acid, are thoſe which yield moſt fixed Alcali; and thoſe from which no acid is ſeparable by diſtillation, are thoſe which yield no fixt alcaline Salt. When vegetables that do abound with acid are burnt with a cloſe ſmothering heat, greateſt part of the acid is gradually diſſipated, and very little Alcali is produced: In a quick open fire, the acid is intimately coagitated with the earth before the diſſipation can happen, and the produce of Alcali is vaſtly larger: What a minute proportion does Charcoal yield, compared to that obtainable by burning the wood at firſt in an open fire! Rotten wood affords little or none.

That the oily matter of the ſubject contributes alſo to the formation of the Alcali, either by furniſhing a material principle to the compound, or by ſerving, when on fire, as a medium for the coagitation and combination of the acid with the earth, appears from hence, that no alcalies are producible but from ſubſtances that contain Oil, and by ſeparating their Oil we diminiſh their produce of Alcali, though not ſo much as by ſeparating their acid. From ſixty-four ounces of dry Wormwood were obtained about two ounces and a half: The ſame quantity, digeſted in Spirit of Wine ſo long as the menſtruum continued to extract any tincture, yielded but one ounce; and when digeſted in water as well as in ſpirit, only nineteen or twenty grains.

Whether obtained in greateſt quantity from freſh or dry plants.

Tachenius and ſeveral others affirm, that plants burnt whilſt freſh, afford much more Salt than if they are previouſly dried: Rivinus, on the other hand, found from experiment, that the yield was in both caſes the ſame. Both theſe obſervations are in certain circumſtances juſt, but neither of them univerſally ſo. In ſome vegetables, the acid principal is of a ſubtile volatile kind, or looſely blended with the other parts, ſo as to exhale in drying: In others, it is groſſer or more intimately combined, and ſuffers no waſte in the exſiccation. The firſt yield moſt Alcali if burnt freſh; the latter yield juſt as much when dried—— Some vegetables, however carefully burnt, loſe their ted in the proceſs, and afford very little Alcali: Guaiacum wood for inſtance. Nevertheleſs, if an extract be made from Guaiacum with water, and this extract gently burnt along with the remaining wood, the aſhes thus obtained will yield on elixation a conſiderably larger quantity (*g*).

Fixt Alcali.

Fixed alcaline Salts are diſtinguiſhed from ſaline ſubſtances not alcaline, by their efferveſcing with all acids, forming with them neutral Salts, precipitating ſolutions made in acids, and changing Syrup of Violets green. They are diſtinguiſhed from volatile alcalies by their fixity (*h*) and fuſibility in the fire, by their deliquiating in the air and never aſſuming a cryſtalline form, changing ſolution of Mercury-ſublimate not white but of an orange-yellow, producing no blue colour with Copper or its ſolutions; raiſing no viſible cloud when placed near an unſtopt bottle of Spirit of Nitre, occaſioning no coldneſs but rather heat on being diſſolved in water. Pure fixed alcalies, diſſolved in water, mingle with a ſolution of any other

Their diſtinguiſhing characters.

(*g*) *More Alcali from the extract, &c.*] Mr. Bourdeline informs us (in the Memoirs of the French Academy for the year 1730) that this experiment ſucceeded with him in a different manner. Six pounds, he ſays, of ſhavings of Guaiacum gave one hundred and thirty grains of fixed alcaline Salt: The ſame quantity, after having been boiled in water for twelve hours, gave ſeventy-eight grains; the decoction inſpiſſated and calcined, only forty-ſeven grains; ſo that here, the extract and the remaining wood did not yield ſo much as the ſame quantity of the wood burnt directly. But it muſt be obſerved, that our author requires the extract and the remaining wood to be burnt *together*, whereas Mr. Bourdeline burnt them *ſeparately*. The fire is required alſo to be *gentle*; a circumſtance which does not a little influence the produce of the Salt; and which in this experiment was not perhaps attended to. I cannot however take upon me to determine whether the yield is largeſt in one or the other caſe.

(*h*) *Fixity in the fire.*] Though theſe Salts, by themſelves, bear a conſiderably ſtrong fire, without any remarkable diſſipation, and give over nothing on being diſtilled in cloſe veſſels, they are far from being abſolutely fixed. They evaporate plentifully in the glaſs-houſe furnace; and by the admixture of certain other ſubſtances they are in part volatalized in a very gentle heat; in a heat no greater than that in which rectified Spirit of Wine diſtils, and the volatile Alcali of Sal ammoniac ſublimes. In effect, when Spirit of Wine is rectified by diſtillation from fixed alcalies, it always carries up with it a portion of the Alcali; and when the volatile Salt of Sal ammoniac is extricated from its acid by the ſame intermedium, it elevates in ſublimation a much larger quantity.

FIXT ALCALI.

pure Alcali, without the leaſt precipitation, turbidneſs, or ſenſible change.

Conſidered as menſtrua.

Fixt alcalies diſſolve Sulphur, Oils, Fats, and reſinous bodies. By Quick-lime their activity is increaſed (*i*), and in this ſtate they diſſolve ſome metallic ſubſtances,

(*i*) *Activity increaſed by Quick-lime.*] For this purpoſe, equal parts of Quick-lime and fixt alcaline Salt are gradually ſprinkled with ſo much water as will ſlake the Lime: More water is then added, the whole ſtirred together and ſuffered to ſtand for a day or two. The liquor poured off clear from the undiſſolved Lime, is the common Sope-ley. The College of London direct their Ley, for making their Almond Sope, to be of ſuch a ſtrength, that an exact wine-pint may weigh juſt ſixteen ounces troy: If it is heavier, for every dram that it exceeds this weight, an ounce and a half of water, by meaſure, is to be added to each pint of the liquor: If lighter, it is to be boiled till the like quantity is waſted, or poured upon freſh Lime and aſhes. The Sope-boilers make their Ley conſiderably ſtronger: A wine-pint commonly weighs above ſeventeen ounces, or about one eighth more than a pint of water.

As theſe Leys are much more acrimonious, and more active menſtrua, than ſolutions of fixed alcaline Salts by themſelves; they retain alſo a proportionably greater degree of activity, when evaporated to a dry Salt. The Salt is ſo corroſive, as not to be ſafely touched with the tongue: Applied to the ſkin, it quickly produces a ſolution of continuity, and hence is commonly made uſe of as a Cauſtic. Some prepare the Cauſtic by adding a quantity of Lime in ſubſtance towards the end of the evaporation of the Ley: This addition renders it leſs apt to liquefy and ſpread upon the ſkin, but at the ſame time leſs ſpeedy in its effect.

Experiments have not diſcovered, that the cauſtic Salt retains any part of the Lime made uſe of in the preparation of the Ley: The Alcali does not gain, but on the contrary ſuffers a notable diminution of its weight; as if the increaſe of its activity was owing not to any thing ſuperadded by the Lime, but to ſome particular matter being ſeparated by it.

Some imagine that the Lime extricates a groſs earth from the Alcali, and in the room thereof ſubſtitutes its own more ſubtile and acrimonious matter. The earth, which precipitates upon mixing a purified ſolution of fixed alcaline Salt with Lime-water, is alledged in proof of this opinion: But that earth appears to be the Lime precipitated by the Alcali, and not a part of the Alcali precipitated by the Lime; Calcined by a ſtrong fire, it returns into Quick-lime.

Dr. Black, in the phyſical and literary eſſays publiſhed by a ſociety at Edinburgh, has advanced a new theory, which he has endeavoured to eſtabliſh by a number of experiments——Fixed alcaline Salts, according to this gentleman, contain a large quantity of air fixed or impriſoned in them: The effervеſcence, which ariſes upon mixing them with acids, is no other than a tumultuary diſcharge of this air. Cauſtic alcalies, he finds, make no effervеſcence with acids, a proof that theſe alcalies have loſt their air; and from the loſs of this principle he deduces their cauſticity. Expoſed long to the atmoſphere, they become ſaturated with air afreſh, and are now found to be mild again and to effervеſce like the plain alcalies. The caſe is the ſame in regard to Quick-lime: Chalk and other calcareous earths abound with air, and effervеſce ſtrongly with acids: By whatever means this air is expelled, they become Quick-lime

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Fixt Alcali.

ſtances, as Calces or filings of Lead; fine filings of Copper, Copper precipitated from blue Vitriol, the Copper in Verdegris, Tin, and Regulus of Antimony: This laſt they corrode into a calx, which by force of fire may be melted into an amber-coloured Glaſs. There are two ways of obtaining ſolutions of Iron in theſe Salts: One, by dropping a ſolution of the metal made in Aqua fortis into a ſtrong alcaline Ley, the acid will be abſorbed and neutralized by a part of the Alcali, and the Iron remains diſſolved by the reſt: The other is, by deflagrating Iron-filings with Nitre; the acid of the Nitre will be diſſipated in the deflagration, and great part of the Iron will diſſolve in water along with the remaining Alcali. Theſe Salts, combined with Sulphur, diſſolve almoſt all the metals and ſemimetals, Gold itſelf not excepted. When made fluid by a ſtrong fire, they diſſolve Flint, Sand, and other earthy bodies, and on cooling concrete with them into a maſs, which proves diſſoluble in water or an indiſſoluble Glaſs, according as the proportion of the earth is large or ſmall. Added to phlegmatic ſpirits, either of the inflammable or volatile urinous kind, they imbibe the redundant phlegm, and thus render the ſpirit more concentrated. In pure vinous ſpirits they do not diſſolve, or only in very ſmall quantity, ſufficient however to give a ſenſible acrimony or alcaline impregnation to the ſpirit. If both the Spirit and the Salt are pure, the liquor receives no colour; but if any oily or reſinous matter be previouſly diſſolved in the ſpirit, or if the Salt be impregnated, though ſlightly, with inflammable matter of any kind, a conſiderably deep tincture will be produced. Fixt alcalies in general heighten the colour of vegetable and animal tinctures, whether drawn with water or with ſpirit;

(which makes no efferveſcence) and by whatever means their natural quantity of air is reſtored, they return to their natural inactivity. Quick-lime abſorbs air from fixed alcaline Salts: Hence in the preſent proceſs, the Salt is acuated, and the Lime rendered inert. When Chalk, diſſolved in acids and thus diveſted of its air, is precipitated by Cauſtic alcalies which have no air to communicate, he finds the precipitate to be a true Quick-lime; whereas, when the precipitation is made by plain alcalies, the Chalk, imbibing their air, returns to an indolent earth.

but they commonly vary the taſte, and often debaſe the ſmell of the preparation.

Combinations of them with acids.

They form with acids different neutral Salts according to the nature of the acid employed; with the vitriolic, a bitteriſh Salt, very difficult of ſolution in water, and not fuſible in the fire, commonly called vitriolated Tartar, the alcaline Salt made from Tartar being that which has chiefly been employed for theſe purpoſes; with the nitrous acid, they form a perfect Nitre; with the marine, a Salt greatly reſembling Sea-ſalt, but not perfectly the ſame, the alcaline baſis of Sea-ſalt being in ſome reſpects different from the common vegetable alcalies. They readily cryſtallize with any of the mineral acids, and with Tartar; with which laſt they compoſe a neutral Salt, much eaſier of ſolution than the Tartar itſelf, and hence called ſoluble Tartar. They do not eaſily cryſtallize with the acid of Vinegar or Lemon juice; theſe mixtures, if by careful management reduced to a cryſtalline form, ſoon deliquiate again in the air.

Their affinities with acids.

There are different ways beſides immediate mixture, of obtaining combinations of fixt alcalies with acids, depending upon their great affinities with one another. Thus, (1.) When any metallic body is diſſolved in an acid, the addition of an alcaline Salt precipitates the metal: If the remaining liquor be filtered and evaporated, it leaves a neutral Salt compoſed ſolely of the acid and the Alcali. Some of the metals ſuffer a notable alteration in this proceſs: Thus the calx of Iron precipitated from the vitriolic acid in making vitriolated Tartar, is ſcarce at all revivable into malleable Iron again. (2.) When acids are combined with volatile alcalies into ammoniacal Salts and this compound mixed with a fixed Alcali; on expoſing the mixture to the action of a moderate fire, in a retort or other convenient veſſel, the volatile Alcali ariſes, and the acid remains combined with the fixed: If it was not for the intervention of the fixt Alcali, it would ſublime in conjunction with the volatile. (3.) In like manner, when Sulphur, or Oils, or Reſins, are diſſolved by a fixt Alcali, the addition of any acid will ſe-

parate

FITX ALCALI.

parate the ſubſtance before diſſolved, the acid and the Alcali uniting together; and even when both of them are previouſly ſaturated, the Alcali for inſtance with Sulphur, and the acid with metal, on mixing the two ſolutions together both the Sulphur and the metal fall, leaving only the Alcali and the acid combined in the liquor. (4.) When the Alcali is previouſly combined with one acid, the addition of a more powerful acid will break the union and diſengage the Alcali from the firſt acid. On the neutral Salt compoſed of fixed Alcali and Vinegar, pour ſome Spirit of common Salt: The acetous acid will inſtantly begin to exhale, and on applying a moderate heat will be totally diſſipated, leaving the Alcali combined with the marine acid. Add to this combination a due proportion of the nitrous acid, and the marine will be expelled, and a perfect Nitre remain. The vitriolic in like manner expels the nitrous, and takes poſſeſſion of the Alcali in its place: This being the moſt powerful acid, is not to be diſlodged by any other.

When this acid is combined with inflammable matter into Sulphur, it loſes its great affinity to alcalies. If the neutral Salt, compoſed of the vitriolic acid and fixed Alcali, be melted with powdered Charcoal, the reſult is a mixture of Alcali and Sulphur. On diſſolving this compound in water, the ſlighteſt even of the vegetable acids precipitates the Sulphur and unites with the Alcali.

Stahl, who firſt diſcovered the production of Sulphur by melting vitriolated Tartar with Charcoal, propoſed a problem to me, "to ſeparate the acid of "vitriolated Tartar, inſtantaneouſly and in the palm "of the hand." Being at Paris in 1715, I propoſed the ſame problem to the elder Geoffroy, and two years after appeared his Memoir, in which he endeavours to give a ſolution of it. He has not however hit the point, his proceſs being no other than that publiſhed by Stahl for making Sulphur, namely fuſion in a crucible and precipitation with acids. The true ſolution is this: Lay on the hand a coal not thoroughly ignited; ſtrew upon the burning part ſome vitri-

Fixt Alcali.

lolated Tartar, blow it a little, and the acid will inſtantly ſeparate and leave the Alcali (*k*).

With inflammable ſubſtances.

Fixt alcalies combined with a little Oil, have their pungency proportionably covered (*l*): With a larger quantity, they form Sope. Impregnated by calcination with an empyreumatic animal Oil (*m*), they acquire ſingular qualities which have not hitherto been ſufficiently examined: Thus, from a ſolution of green Vitriol and Alum, they precipitate the fine blue Fecula called Pruſſian blue.

SOPES.

Sopes.

THE fine hard white Sopes are made with Oil Olive, and an Alcali acuated with Quick-lime,

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(*k*) *Promblem of ſeparating the acid of vitriolated Tartar.*] Another ſolution of this problem has been mentioned in the firſt volume. In the author's ſolution given above, the ſeparation, though it cannot be ſaid to be performed immediately on the palm of the hand, is the moſt perfect and apparent, only the acid being diſſipated, and the Alcali left by itſelf pure.

(*l*) *Pungency covered by Oil.*] Hence ſome have endeavoured to improve the preparation of fixed alcaline Salts for medicinal uſe. Inſtead of burning out all the Oil of the vegetable by thorough calcination of the aſhes in an open fire, ſo as to obtain a pure Alcali; they endeavour to retain in the Salt as much as poſſible of the Oil, by ſlowly incinerating the ſubject with a cloſe ſmothering heat. Theſe oily alcalies, or *medicated* Salts, as they are called, are of a brown colour, and in taſte much leſs acrimonious than the purer white alcalies.

(*m*) *Fixt alcalies impregnated with animal Oil.*] This impregnation is effected by mixing pure fixt alcaline Salt with twice its weight of ox-blood evaporated to dryneſs and reduced into powder; and calcining the mixture in a crucible, till it ceaſes to flame. The Salt is then pulverized and thrown, whilſt hot, into twice its quantity or leſs of water, and the Lixivium paſſes through a filter.

The properties of this Lixivium, hitherto obſerved are theſe. Mixed with a ſolution of Alum and Vitriol of Iron, it precipitates green and blue Feculæ Added to a ſolution of Gold made in Aqua regis, or of Silver, Quickſilver, or Zinc in Aqua fortis, in ſuch proportion as to ſaturate the acid, it precipitates the metals like ſimple alcalies: But if a larger quantity of the Ley is afterwards added, all the Precipitates are rediſſolved by it. Mr. Margraff relates (*Memoires de l'Acad. de Berlin,* 1745) that even when the Precipitates have been carefully edulcorated, or waſhed from their ſaline matter by hot water, they ſtill readily diſſolve in the Lixivium; and this, whether the precipitation has been made with the Lixivium itſelf, or with common alcalies. Lead and Tin reſiſt this menſtruum: After they have been thrown down by it from their ſolutions in acids, they are not taken up again by a larger addition.

Cauſtic alcalies, applied in the ſame manner, are not found to diſſolve any of the above metals.

which

Sopes.

which promotes the action of the Salt upon the Oil, and at the ſame time diſpoſes the Sope to a hard and dry conſiſtence, which it does not eaſily aſſume when made with plain Alcali. I have tried to prepare Sope with alcaline Ley alone, and with Lime-water alone: With the firſt, the Sope turned out ſoftiſh and unctuous: With the latter, I obtained, not a true Sope, but a hard brittle compound, from which the Oil ſeparated on trying to diſſolve it in water. A quantity of common Salt is generally added in the proceſs, but it does not enter the compoſition of the Sope: The uſe of this Salt is, when the Oil has been incorporated, by boiling, with the alcaline Salt of the Ley, to promote the ſeparation of the ſaponaceous concrete from the water: It is only at this period that the Sea ſalt is added. The Sea-ſalt may be recovered from the remaining liquor by cryſtallization; if any part of it happens from unſkilful management, to be retained in the Sope, it ſeparates in little cryſtals as the Sope dries.

The greateſt quantities of Sope are made in Spain, Portugal, France and Italy; Oil Olive being in thoſe countries moſt plentiful. The moſt common and the cheapeſt, of the foreign Sopes, is that of Venice. I have ſeen the preparation of this ſort: It is made from three parts of good Oil Olive, and two of a cauſtic Ley; which Ley is drawn from two parts of Spaniſh Soda and one of Quick-lime, with a ſuitable quantity of water. No metalline veſſels are made uſe of: The boilers are compoſed of building ſtone, joined by a particular cement, and ſecured with iron cramps: In theſe the Oil and Ley, to the quantity of ſome hundred weights at a time, are kept gently ſimmering for ſeveral days and nights. The Venetians prepare alſo a green Sope, from old Oil, the Mother-ley of the white Sope, and other refuſe matters, adding a certain portion of the juice of Beet-leaves; which communicates the green colour: The juice is preſſed out by a horſe-mill conſiſting of an horizontal ſtone, with a perpendicular one turning upon it, as in the Gunpowder mills——The common coarſe Sopes are made with Tallow; and the ſoft, blackiſh and greeniſh ſorts with Train-oil.

Sope with eſſential Oils.

Fixed alcalies unite much more difficultly with eſſential Oils than with the expreſſed. For making a Sope with Oil of Turpentine, formerly celebrated as a medicine under the names of Sope of Tartar, the Univerſal Corrector, *&c.* Different proceſſes have been purſued, and all of them tedious or defective. Some mix the Oil of Turpentine with a well calcined Salt of Tartar, and ſtir them together every day for half a year or longer, till the union is compleated: Some dry the mixture occaſionally, as often as it is found to have imbibed moiſture from the air. Some have ſecured the mixture in a ſtrong glaſs fixed to the clapper of a mill or the ſail of a windmill, that by this means it might be kept in conſtant agitation; but ſimple agitation is not ſufficient. Some boil the Oil with a cauſtic Ley, keeping the whole continually ſtirring, nearly in the ſame manner as for making Sope with expreſſed Oils. Others pulverize the Salt, ſtrongly heated, in a mortar, and pour upon it whilſt very hot, the Oil of Turpentine likewiſe heated: By this method a Sope is moſt expeditiouſly obtained, but the more ſubtile parts of the Oil are diſſipated. The beſt way is, to mix the Oil and Salt together moderately hot, and digeſt them in a low glaſs body for a day, then grind and digeſt them again (*m*). It is not of much importance to be curious about the proportions: If the Salt predominates, the Oil will the more readily and more perfectly unite with it, and

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(*m*) *Combination of fixed alcalies with eſſential Oils.*] Stahl has diſcovered an eaſy method of obtaining this union, by the mediation of Spirit of Wine—If ſome fixt alcaline Salt be put into a vial, a phlegmatic Spirit of Wine poured upon it, and above this a light diſtilled Oil; the ſeveral matters, ſhaken together, ſeparate again, and form four diſtinct ſubſtances, which ſome of the fanciful ſons of chemiſtry have reſembled to the four elements ſeparating from the chaos; the Alcali at the bottom repreſents earth; the phlegm of the ſpirit, imbibed by a part of the Alcali, repreſents water; the ſpirit itſelf ſtands for air; and the diſtilled Oil for fire. Theſe phænomena having been two or three times exhibited, and the mixture two days after, being ſhaken a third time, no ſeparation enſued, the Alcali and Oil uniting into a thick ſaponaceous maſs, the product here required. To ſucceed in this experiment, the quantity of Oil ſhould be ſmall.

when the union is obtained, the ſuperfluous Salt may be ſeparated by deliquiation: The proceſs may be finiſhed by drawing over ſeveral times from the Sope ſome rectified Spirit of Wine, by which, if there is any redundant Oil, it will be in good meaſure ſeparated. The other eſſential Oils are ſtill more difficultly combinable with alcalies than that of Turpentine; but empyreumatic Oils unite more eaſily. Volatile alcalies do not form a Sope with any kind of Oil: They only thicken expreſſed Oils into the conſiſtence of a liniment; and it is only the Spirit of Sal ammoniac made with Quick-lime that does this.

Common hard Sope diſſolves in water (though not perfectly) by virtue of its alcaline Salt. But it diſſolves alſo, and that in a more perfect manner, in rectified Spirit of Wine, though this menſtruum has no action either on the Oil or the Salt by themſelves: It is obſervable, that a ſmall proportion of Sope gives a quite thick conſiſtence to a very conſiderable quantity of the ſpirit. On adding any acid to a ſolution of Sope, its ingredients ſeparate from one another, the Alcali being abſorbed by the acid, and letting go the Oil (*n*).——Sope is uſed medicinally as a detergent and deobſtruent: It diſſolves tenacious mucus, and promotes the natural excretions. If there are any medicines capable of diſſolving the calculus in the bladder, Sope is one of the principal (*o*).

PART

(*n*) *Solubility of Sope.*] This concrete diſſolves ſtill more perfectly, and in larger quantity, in pure proof-ſpirit. Sixteen ounces of rectified ſpirit ſcarcely diſſolve one ounce of Sope; but the ſame quantity of a mixture of equal parts of rectified ſpirit and water diſſolves with eaſe above five ounces into a colourleſs tranſparent liquor. This ſolution is commonly called liquid Sope.——It is obſervable that the Oil ſeparated from ſolutions of Sope by means of acids, diſſolves, like eſſential Oils, in Spirit of Wine.

(*o*) *Additional Article.*

VEGETABLE EARTH.

THE earthy parts of vegetables are not to be ſeparated, in a tolerably pure ſtate, but by diſſipating or deſtroying the other principles. There are two general means of effecting this; putrefying, and burning the ſubject.

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VEGETABLE EARTH.

The earths procured by theſe two proceſſes, from one and the ſame plant, are in all their obvious properties remarkably different from one another; but in thoſe obtained by one proceſs from different plants, no diverſity has been obſerved. All vegetables ſeem to be reſolved by putrefaction into one ſimilar earth, and by fire into another.

The earth produced from vegetables by putrefaction, of which common black mould is principally compoſed, approaches ſomewhat to the nature of the leſs tenacious kinds of clayie Earths or boles: Like them it readily imbibes water, extends a little when moiſtened, proves in ſome ſmall degree ductile, and is not acted upon (in the cold or in a moderate warmth) by acid liquors: It differs from them in being leſs coherent, and acquiring no additional hardneſs in the fire. Calcined by a very ſtrong fire it does not become ſimilar, either in appearance or in its chemical properties, to the earth procured by burning the plant at firſt——Some have ſearched in mould for the immediate pabulum or nutrimental matter of vegetables, but the enquiry has hitherto been fruitleſs: The richneſs of mould as a ſoil for plants, does not ſeem to depend on its having any particular ſaline or other impregnation, but on its property of imbibing and retaining humidity more effectually than any other earth.

The earth prepared by fire, or the aſhes of vegetables freed from their ſaline parts, diſſolves readily and plentifully in all acids, and appears to be ſimilar to the mineral earth called Magneſia, or the earthy baſis of the bitter purging Salts of mineral waters. It forms the ſame compounds with acids; and like that earth alſo, it acquires no acrimony nor any change of its quality, from fire. By the proceſs of putrefaction, in mixture with putreſcible ſubſtances, it ſuffers no change, the incinerated earth being recoverable from that which the putrefaction produced, by means of acids; and afterwards from the acids, by precipitation with alcaline Salts and by calcination; and proving ſtill, on all the trials that have been made, the ſame earth as at firſt.

The vitrification of the mineral Magneſia has not been tried. The vegetable incinerated earth, mixed with a very moderate proportion of fixed alcaline Salt, vitrifies with eaſe, and forms a greeniſh hard Glaſs. The common green Glaſs-bottles are made chiefly of vegetable aſhes, that have not been freed from the Salt produced in the burning; the proportion of which is often ſufficient for the fuſion, not only of the earthy part of the aſhes themſelves, but likewiſe of an additional quantity of Sand or other mineral Earths. The warm imagination of ſome of the chemiſts has wantoned in airy ſpeculations about this green Glaſs, impreſſed with the indelible character of the verdant kingdom, tinged with an unſubduable green anima of plants.

In ſome chemical operations, where retorts or other veſſels of green Glaſs are expoſed for a conſiderable time to the action of a ſtrong fire in a Sand bath, the bottom of the Glaſs that had been in contact with the Sand, is often found tinged in part with an opake whitiſhneſs. From this obſervation I was induced to cement pieces of Glaſs in a crucible, with Sand and many other powdery matters: In theſe experiments, the Glaſs frequently ſuffered a remarkable change in its whole ſubſtance, being converted throughout into a body more reſembling a fine kind of earthenware than Glaſs. Mr. Reaumur was led to the ſame diſcovery by analogical reaſoning: From the effects of Bone-aſh, Charcoal, Soot, *&c.* in ſoftening caſt Iron, and turning forged Iron into Steel, he ſuſpected, that the ſame ſubſtances might produces alſo ſome notable alterations in Glaſs; and accordingly firſt made trial of thoſe powders, and afterwards of others——The following is the general reſult of the experiments made upon this ſubject by him *. An account of our own

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* In the Memoirs of the Royal Academy of Sciences for the year 1739.

VEGETABLE EARTH.

will follow this to the preſs, in a work which I have long promiſed to the publick.

Green Glaſs, ſurrounded with white earthy matters, as white Sand, Gypſum or Plaſter-of-Paris, *&c.* and expoſed to a conſiderable heat not ſtrong enough to alter its figure, as that of a potter's furnace, acquires different ſhades of blue, and by degrees begins to grow white On breaking the Glaſs, the white coat appears to be compoſed of fine, gloſſy, ſattin-like fibres, running tranſverſely and parallel to one another; the Glaſs in the middle being ſcarcely altered. On continuing the cementation, the change proceeds further and further, till at length the white fibrous parts from both ſides meet in the middle, and no appearnce of Glaſs remains. By this proceſs entire veſſels of Glaſs are converted into veſſels of Porcelaine.

The ſubſtance, into which the Glaſs is thus converted, is opake, compact, internally of great whiteneſs, equal to that of the fineſt China-ware, but externally of a much duller hue. It is conſiderably harder than Glaſs, much leſs fuſible in the fire, and ſuſtains alternations of heat and cold without injury. Veſſels of it, cold, bear boiling liquors, and may be placed on the fire at once, without danger of their cracking. I have put a veſſel of this Porcelane, ſays the author, into a forge, ſurrounded it with coals, and kept blowing vehemently for near a quarter of an hour: I have melted Glaſs in this veſſel, without its having ſuffered any injury in its figure.

If means could be found of giving the outſide a whiteneſs equal to that of the internal part, Glaſs veſſels, might thus be converted into a valuable kind of Porcelane ſuperior to all that have hitherto been made. Chemiſtry may receive from this diſcovery in its preſent ſtate, ſuch veſſels as have long been wanted; veſſels, which with the compactneſs and impenatrability of Glaſs, are free from its inconveniencies.

This diſcovery has not as yet been brought to the degree of perfection which the author thinks it capable of being brought to. Many other experiments remain to be made, with different kinds of Glaſs, as well as with different cementing materials.

The common green glaſs bottles yielded a Porcelane of tolerable beauty; window glaſs and drinking glaſſes a much inferior one; whilſt the finer cryſtalline glaſſes could not be changed into Porcelane at all. Whence it is natural to preſume, that there may be ſome ſorts of Glaſs more proper than any that have yet been tried. It may perhaps be found neceſſary to prepare a coarſe kind of Glaſs on purpoſe.

With regard to the cementing materials, he finds white Sand, and Gypſum, or rather a mixture of both, to anſwer the beſt of any that have been tried. Coloured earths generally make the external ſurface of a lighter or deeper brown colour; Soot and Charcoal, of a deep black; the internal part being always white. Theſe external colours may be ſo managed as to prove in ſome caſes an embelliſhment. The glazing and vitreous colours, commonly applied upon other Porcelanes, he finds, may be equally applied upon this.

Mr. Reamur ſuppoſes (agreeably to the theory, by which he was led to the diſcovery), that the converſion of Glaſs into Porcelane is owing to the ſulphureous or unvitreſcible particles of the matters with which it is cemented, being forced into it by the heat.

PART III.

CHEMICAL HISTORY OF THE ANIMAL KINGDOM.

SECTION I.

Of ANIMAL SUBSTANCES *in general, and their* NATIVE PRINCIPLES.

ANIMALS.

ANIMALS are nouriſhed, mediately or immediately, by vegetables. The alimentary ſubſtance, of whatever kind, is changed in the body, by a power of which we know only the effect, into two kinds of matter; (1) An excrementitious one, which paſſes off through the inteſtines; and (2) A fluid which is the direct pabulum of the animal; which is tranſmitted, though not without new changes, through all the veſſels; from which are ſecreted and elaborated, by different organs, all the animal juices deſtined to different purpoſes in the œconomy, and all the excrementitious fluids; from which the ſolid parts alſo receive their nutriment and increaſe.

How widely do theſe ſubſtances differ from one another, as well as from every thing that pre-exiſted in the alimentary ſubject! We have no where more ſtriking examples of the converſion of matter into new forms, than in the bodies of animals; changes effected

effected by a natural proceſs, which art has attempted in vain to imitate or account for.

Different alimentary ſubſtances are not by this proceſs equally changeable: They differ obviouſly in regard to the facility of their being digeſted or aſſimilated in the body: Perhaps alſo there are differences in the quality of the animal juices elaborated from different aliments. The common experience of the tables ſhews differences in animal fleſh, which may in great part be aſcribed to the food.

There are many ſubjects of the vegetable, as well as mineral kingdom, (excluſive of the directly noxious ones) whoſe active principles appear to be unſubduable by the digeſtive organs of animals, and which tranſmit their own ſpecific qualities to the blood, and to fluids ſecreted from it. Thus Rhubarb communicates its purgative virtue to the milk of the breaſt, and its deep yellow colour to the urine *(a)*.

Animal Subſtances.

ANIMAL SUBSTANCES, chemically examined, are found to contain, beſides the general principles Water and Earth:

1, A gelatinous matter, more or leſs tenacious, ſoluble in Water, indiſſoluble in rectified Spirit of Wine. This principle appears to be of two kinds; one which diſſolves in boiling water more readily than in cold; and another, which, though eaſily ſoluble in the cold, is by boiling water coagulated and rendered indiſſoluble. The gelatinous matter of the ſolid parts is of the firſt kind; that of ſome (perhaps of all) of the fluids, of the laſt.

2. A ſubſtance diſſoluble in Spirit of Wine, and which remains behind upon evaporating the ſpirit, containing oftentimes the taſte, particular flavour, medicinal activity, or colour, of ſuch ſubjects as are eminently poſſeſſed of thoſe qualities, as Cantharides, Caſtor, Cochineal, *&c.*

(a) *Qualities of vegetables unſubdued in animal bodies.*] Many other examples of this kind might be mentioned; among which perhaps there is none more remarkable than the experiments formerly related (p. 164.) of the bones of animals being ſtained of a deep red by a red drug (Madder) taken with the food.

3. An

3. An unctuous or fat matter, of different degrees of conſiſtency, eaſily liquefiable by heat, not diſſoluble in water or in ſpirit, but for the moſt part miſcible with cauſtic alcaline Lixivia into Sope.

4. A volatile principle; which exhales in the heat of boiling water, and which may ſometimes be collected by diſtillation in the form of an eſſential Oil (*b*).

5. An acid; which ſeems to be more frequent in the animal kingdom than the chemiſts have commonly imagined; for beſides the manifeſt acid of certain inſects, experiment has diſcovered that there is a latent acid principle in moſt kinds of animal ſubſtances.

Animal Subſtances.

THESE may be looked upon as the native principles of animal matters; all the conſiſtent parts of animals being reſoluble into more or fewer of theſe, without deſtroying the original qualities of the ſubject; which qualities are uſually preſerved in one or other of the parts ſeparated. There are however ſome particular animal juices, whoſe principles cannot eaſily be referred to any of theſe.

The foregoing principles are in ſome degree analogous to the Gums or Mucilages, the Reſins, the expreſſible and eſſential Oils, and the eſſential Salts of the vegetable kingdom. But notwithſtanding the agreement of the reſpective principles of the two kingdoms in ſome of their general properties, thei internal conſtitution appears to be eſſentially diſtinct How different is an animal gelly, thrown in the fire, from a vegetable Gum, in its inflammability and in its ſtench!

(*b*) *Eſſential Oil.*] Our author appears to be the firſt who diſcovered any truly eſſential Oil in the animal kingdom; ſee the examination of ants in the following ſection. It is ſaid that ſome of the ſtrong-ſcented animal ſubſtances alſo, as Caſtor, yield on being diſtilled with water, when large quantities are ſubmitted to the operation at once, a ſmall portion of actual Oil containing the whole ſmell of the ſubject. From hence ſome have preſumed, that animal odours in general reſide, like thoſe of vegetables, in a principle of this kind, though the proportion of Oil, in animal as well as in many odoriferous vegetable ſubſtances, is too ſmall to be collected on diſtilling moderate quantities of the ſubject.

The

VOLATILE SALTS.

The ſoft and fluid parts of animals (*c*) are in general much more diſpoſed to putrefy than thoſe of vegetables; and when putrefied, prove more acrimonious and more offenſive: Compare a rotten apple with cadaverous fleſh, and how different will putrefaction appear to be in the two kingdoms! Vegetables by putrefaction approach in ſome meaſure to the nature of animal ſubſtances in their perfect ſtate; not indeed in regard to their native principles, but in regard to thoſe into which they are ultimately reſoluble by the deſtructive action of a ſtrong fire.

A degree of putrefaction oftentimes takes place in the bodies even of living animals: Thus, after long abſtinence from food and liquors, the juices are found to be thin, ſaline, acrimonious, and fetid. From ſuch a ſtate of the juices, brought on by various cauſes, ariſe many diſorders of the animal machine, which have in vain been attempted to be counteracted or explained upon mechanical principles (*d*).

Many

(*c*) *Soft parts diſpoſed to putrefy.*] The ſolid parts alſo, and even thoſe which have very little of the animal principles beſides the earth, are found, when reduced into ſmall parts and kept moiſt, to be greatly diſpoſed to run into putrefaction. I have ſeen the common abſorbent powders, as Crabs-eyes and Crabs-claws, when levigated with water and ſet by moiſt, in large quantities together and in hot weather, become in ſome degree putrid in a few hours.

(*d*) *Animal putrefaction.*] The doctrine of putrefaction, both in living and in dead animals, has lately received great light from the curious experiments and obſervations of Dr. Pringle, many of which are intereſting to the chemiſt as well as the phyſician. See the appendix to his *Obſervations on the Diſeaſes of the Army.*

He obſerves, that during putrefaction, a quantity of air is generated, all the humours become gradually thinner, and the fibrous parts more lax and tender; that the craſſamentum of human blood changes by putrefaction to a dark livid-coloured liquor, which tinges a large quantity of ſerum of a tawny hue like Ichor, &c. and recent urine of a flame colour, like that in fevers and the ſcurvy; that this laſt mixture, on ſtanding an hour or two, gathers a cloud like that of the crude water of acute diſtempers, with ſome oily matter on the ſurface like the ſcum on ſcorbutic urine; that the ſerum of blood depoſites, in putrefaction, a ſediment reſembling well digeſted pus, and changes to a faint olive-green; and that the green colour of ſalted meats is owing to this cauſe, and not, as is commonly ſuppoſed, to the brine.

He finds that putrefaction is prevented or retarded by all ſaline ſubſtances, even by fixed and volatile alcaline Salts, which have been commonly ſuppoſed to produce a contrary effect, by vinous ſpirits, aromatics; many gummy-reſins, the bitter, aſtringent, acrid herbs, &c. That Sea-ſalt, the common ſeaſoning of our proviſions, is one of the

weakeſt

Many animal juices are diſpoſed likewiſe to coagulate and grow thick, and to change in part into hard concretions, without any manifeſt evaporation of the fluid. By this property they are fitted for augmenting, and repairing the waſtes of the ſolids. Thus the ſhells of ſundry fiſhes receive annually a new incruſtation; and thoſe of others are annually thrown off and ſupplied by new ones produced from the juices of the animal.

It has been ſuppoſed, that the teſtaceous, calculous, and other ſolid animal concretions, are only a bare ſeparation and coaleſcence of the earthy particles previouſly diſſolved or held ſuſpended by the fluids; but a chemical examination ſhews that they are more. Evaporate the watery part of any animal juice, and by a ſuitable fire burn off the combuſtible principles, that only the earth may remain: Procure alſo, by the like means, the pure earth of any of the hard parts of animals; and the two earths will be found eſſentially different from one another (e).

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weakeſt in antiſeptic power; that vitriolated Tartar for inſtance is twice as ſtrong; Sal ammoniac thrice, Nitre upwards of four times, fixed and volatile alcalies as much, Borax above twelve times, Salt of Amber above twenty times, Alum above thirty times, and the ſoluble part of Camomile-flowers not leſs than one hundred and twenty times, as ſtrongly antiſeptic as common Salt... That animal ſubſtances already corrupted, are capable of being recovered and made ſweet again: A ſmall piece of putrid fleſh, ſteeped two or three days in an infuſion of Camomile renewed every day, loſt its offenſiveneſs; and being then put into a freſh infuſion, was kept a twelvemonth in the ſame liquor, and ſtill remained firm and uncorrupted.. That Sea-ſalt in ſmall quantity, as ten grains to two drams of fleſh and two ounces of water, inſtead of reſiſting, both haſtens and heightens the putrefaction.. And that ſome of the ſoluble earths alſo, as Chalk, promote putrefaction; whilſt others, as egg-ſhells, ſeemed to retard it.

It is remarkable, that notwithſtanding the ſtrong tendency of animal matters to putrefaction, yet broths made from them with the admixture of vegetables, inſtead of putrefying, turn ſour. Dr. Pringle finds that animal fleſh in ſubſtance being beat up with bread or other farinaceous vegetables, and a proper quantity of water into the conſiſtence of a pap, this mixture likewiſe, kept in a heat equal to that of the human body, grows in a little time ſour, whilſt the vegetable matters without the fleſh ſuffered no ſuch change. He obſerved, that in a ſmaller degree of heat, the change was more ſlow, and that the matter before it became acid yielded a vinous ſmell like that of fermenting liquors.

(e) *Earths from the ſoft and hard parts different.*] The principal difference I have obſerved is this; that the earths of the ſoft parts of animals, at leaſt of thoſe which were examined, diſſolved with eaſe in the vitriolic acid, whilſt thoſe of the hard parts did not diſſolve at all, any more than the mineral calcareous earths. See the article of animal earths at the end of next ſection.

SECT. II.

Products from Animal Subſtances by Fire.

ANIMAL SUBSTANCES.

ANIMAL Subſtances (a few excepted) on being diſtilled in cloſe veſſels by a ſtrong fire, give over, not a manifeſt acid liquor as vegetables do, but an urinous or volatile alcaline one, and commonly more or leſs of a concrete volatile alcaline Salt; together with an empyreumatic Oil, more fetid than the Oils of vegetables, and of a different kind of fetor. On calcining the remaining coal in open veſſels, and elixating the aſhes with water, we ſometimes obtain a portion of a kind of fixed ſaline matter, but very rarely a perfect alcali like that extracted from the aſhes of vegetables (*f*).

Before we proceed to examine Animals and their parts in particular, it will be proper to give an account of the preparation and properties of the general products obtained by this operation.

I. *Volatile Animal Salts and Spirits.*

VOLATILE SALTS.

WE have formerly ſeen that the alcaline Salt procurable from vegetables is wholly a child of art. The volatile alcalies obtained from animals are in like manner artificial productions, never found to exiſt naturally in any animal ſubſtance in its perfect ſtate: They are generated by the action of fire, and by putrefaction; and not by any known power beſides.

So ſoon as an animal ſubſtance begins to putrefy, it begins to diſcover an alcaline quality; and this volatile ſubſtance, now produced in it, may be ſeparated

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(*f*) *Salt from the aſhes.*] The aſhes of truly animal ſubſtances, are never obſerved to yield any perfect alcaline Salt like that produced from vegetables. Wherever we obtain a fixed Alcali of this kind, the ſubject is judged, in ſo far as it affords that Salt, to be of a vegetable nature, or to participate of a vegetable impregnation.

The ſmall portion of ſaline matter, extracted from the aſhes of ſome animal ſubſtances, appears to be chiefly of the marine kind. Our author himſelf finds, in examining bones and horns, that a Salt of this kind is obtainable from them in their crude ſtate, by boiling them with water. If the acid of this Salt ſhould be diſſipated in the burning, ſo as to leave the Alcali behind; this Alcali may be eaſily diſtinguiſhed from thoſe of the vegetable kingdom by its forming with the vitriolic

Volatile Salts.

by diſtillation in a very gentle warmth (*g*). Hence in the bodies of animals themſelves, the juices are ſometimes found to be alcaleſcent; more or leſs, in proportion to the degree to which the putrefaction has ariſen.

From thoſe ſubſtances on the other hand, which have not ſuffered putrefaction, no Alcali is obtainable without a ſtrong heat; the formation of the Alcali, when effected by fire alone, not taking place till the ſubject is in a ſtate of ignition. The Alcali itſelf, when once produced, whether by fire or by putrefaction, is always of the ſame volatility.

Diſtillation.

IN order to the preparation of volatile Salts, the ſolid parts of animals, which are little diſpoſed to putrefy, as Horns, Bones, Hoofs, Hair, *&c.* are diſtilled in earthen or coated glaſs retorts placed in a reverberatory or other furnace, capable of giving a conſiderably ſtrong heat: In the large way of buſineſs, an iron pot is uſed for the diſtilling veſſel. The fire being increaſed by degrees, there ariſes firſt a phlegmatic liquor, in greater or leſs quantity according as the ſubject was leſs or more dry: In the progreſs of the operation, the liquor that diſtils proves more and more alcaline and urinous, and is now called Spirit: Soon after, a concrete Salt appears in the recipient, together with a yellow Oil; which is

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acid a bitter neutral Salt, eaſily ſoluble in water and fuſible in the fire, called *Sal mirabile*, whilſt the vegetable Alcali forms with the ſame acid a Salt leſs bitter, very difficult of ſolution, and not at all fuſible, called vitriolated Tartar.

(*g*) *Putrid ſubſtances alcaline — yield their Alcali in gentle warmth.*] This is the general doctrine of the chemiſts, but it does not appear to be ſtrictly juſt. They ſeem to have been miſled by applying to all animal ſubſtances what they had found to obtain in one, but what a further examination ſhews to obtain in very few, if any, beſides, alcaline in any conſiderable degree.

Putrefied urine gives plain marks that it contains a volatile Alcali already generated: But putrid blood and fleſh are not ſenſibly alcaline, and yield no Alcali in diſtillation till after the phlegm has ariſen.

We have formerly ſeen that volatile alcalies are powerfully antiſeptic. Perhaps, as Dr. Pringle obſerves, it is owing to this Alcali in putrefied urine, that its ſteams are ſo little prejudicial to health; whilſt thoſe of other putrid animal matters, which want that corrector of putrefaction, are often productive of dangerous diſeaſes.

ſucceeded,

ſucceeded, on increaſing the fire to the utmoſt, by a dark coloured thick Oil.

VOLATILE SALTS.

Liquid ſubſtances, as Urine and Blood, are previouſly putrified, and then diſtilled in a ſand-bath. In regard to the putrefaction, the ſubject ſhould be completely putrid, but the proceſs muſt not be carried too great a length; for if it is, the volatile Salt will be diſſipated in the air, and nothing will ariſe in the diſtillation but a little fetid Oil. The diſtilling veſſel ſhould not be above one half filled, theſe kinds of liquids being extremely apt to froth up and run over: Nor ſhould the junctures be very cloſely luted, leſt the expanſive vapours which ariſe from theſe ſubjects ſuddenly and in great abundance, burſt the veſſels or blow off the head or receiver. This laſt caution is equally neceſſary to be obſerved in the foregoing diſtillation of ſolid ſubſtances by a reverberatory or naked fire.

The liquor which in theſe proceſſes is called Spirit, is no other than a portion of the volatile Salt diſſolved in the water or phlegm, and tainted with the fetid Oil. The Salt itſelf alſo, which concretes in a ſolid form about the ſides and in the upper part of the recipient, is ſtrongly impregnated with the ſame fetid ſmell, and with the unſightly yellow or browniſh colour of the Oil.

Rectification.

IN order to ſeparate and purify the ſeveral products, the Salt may be waſhed down by ſhaking about the liquid matters in the receiver, and the whole poured into a wide mouthed glaſs: On ſtanding, the Salt falls to the bottom, the Spirit ſwimming above it, and the Oil on the top. The liquor may then be poured off from the Salt, and the Oil and Spirit parted from one another by a funnel or otherwiſe (b).

After this groſs ſeparation, the ſpirit is to be diſtilled over again, in a glaſs retort, with a very gentle heat; and the fire diſcontinued, or the receiver

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(b) *Spirit and Oil parted*] The Spirit may be commodiouſly ſeparated from the Oil by filtration through wet paper, which will retain all the Oil that is not intimately combined or diſſolved in it.

Volatile Salts.

changed, as ſoon as its fetid Oil is perceived to ariſe. By repetitions of this proceſs, it loſes its offenſive ſmell, though it cannot be totally diveſted of its Oil.

The Salt is rectified or purified by repeated ſublimations; with the addition of animal or vegetable aſhes, fine white Clay, or other like earthy powders, which abſorb and keep down a portion of the Oil. Great part of the Oil may be ſeparated alſo by digeſtion with highly rectified Spirit of Wine; this menſtruum diſſolving and extracting the Oil, without being able to diſſolve any conſiderable quantity of the Salt: The little of the Salt which it does take up, may be ſeparated by diſtillation in a tall glaſs with a gentle heat; the Salt ariſes firſt, and afterwards the Spirit, greateſt part of the Oil remaining behind.

The Salt contained in the volatile Spirit may in like manner be recovered in its ſolid form by gentle diſtillation. For this purpoſe, the proceſs is to be ſtopt as ſoon as the Salt has ariſen, before any phlegm comes over to diſſolve it, whereas, in rectifying it for Spirit, the diſtillation is continued till phlegm enough has ariſen to diſſolve the whole of the Salt (*i*).

Volatile Salts can ſcarcely, by the above methods of rectification, be rendered perfectly pure. Though when newly rectified, they appear ſufficiently white, and diſcover only their own pungent odour, yet in long keeping they contract a brown colour and an ill ſmell, and thus betray how imperfectly they had been freed from the Oil.

(*i*) *Phlegm enough to diſſolve the Salt.*] The diſtillation ſhould be ſtopt as ſoon as ever the Salt appears to be all diſſolved; for the phlegm drawn off after this period, can ſerve only to weaken and dilute the Spirit in proportion to its quantity. The author of the *Pharmacopœia reformata* adviſes the operation to be diſcontinued a little before the total diſſolution of the Salt, and it were to be wiſhed that this method was received in practice. The ſtrength of volatile ſpirits, at preſent very vague and uncertain, and not eaſily to be judged of, would then be always nearly of one ſtandard; for if a little of the Salt remains undiſſolved at the bottom of the liquor, we may be ſure that the ſpirit is ſaturated, or impregnated with as much as it can take up. This method would likewiſe prevent the frauds that have been practiſed in regard to theſe kinds of preparations; for a little ſolid Salt remaining at the bottom (provided this Salt be found to be a volatile alcaline one, which is very eaſily determined) would be a certain mark that the ſpirit is not only ſtrong, but free from ſophiſtication.

The

VOLATILE SALTS.

The moſt effectual method of purifying them, though too expenſive an one for common purpoſes, is, to combine them with mineral acid ſpirits, that of Sea-ſalt for inſtance.——When volatile alcalies are ſaturated with the acid, they form a neutral Salt of a middle degree of volatility; if the filtered liquor be ſet to evaporate, the water totally exhales long before the Salt begins to ariſe. Some of the chemiſts, anxious when they had Salts that were fixed, to make them volatile, and when they had volatile ones to make them fixed, imagined they had here a curious fixation of the volatile Alcali, and expected from it uncommon effects, not conſidering, that the compound is by no means an alcaline, but a neutral Salt, and no other than plain Sal ammoniac; for common Sal ammoniac is an artificial neutral Salt, compoſed of volatile Alcali and marine acid. (See Vol. I.) If this compound be mixed with fixed Alcali or with Chalk, and ſet to ſublime in a retort or other proper veſſel, the acid will be abſorbed by the fixed Salt or the Earth, and the volatile Salt will ariſe pure.

Their identity and diſſimilarity.

THE volatile Salts and Spirits, obtained from different animal ſubſtances, have been ſuppoſed to poſſeſs ſpecific medicinal virtues, correſponding to thoſe of the ſubject they were produced from. But fire and putrefaction, the agents by which theſe products are procured, deſtroy the ſpecific qualities of all animals and vegetables; and the volatile matters, that ariſe in the diſtillation, have no more reſemblance to the original ſubject than the coal that remains behind. The Salt and Spirit of Cantharides have no greater acrimony than thoſe of Hartſhorn-jelly: Thoſe of the moſt poiſonous and loathſome animals, the Tarantula, the Scorpion, the Aſp, the Spider, and the Toad, are neither leſs innocent nor more offenſive, than thoſe of the Partridge, the Lark, and the Ortolan.

Though theſe preparations, however, poſſeſs nothing of the properties of the ſubject which afforded them, it does not follow, that in their ordinary ſtate they

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they are all perfectly the ſame, as ſome have too haſtily concluded. When brought to their ultimate degree of purity, their identity is not to be denied: But ſo long as they participate of Oil, which they always do as prepared in the common manner for medicinal or other uſes, thoſe Oils may vary their quality; for though pure animal Salts appear all to be one and the ſame, yet animal Oils are not ſo. The Salts of different animal ſubſtances exhibit, by virtue of their diſſimilar Oils, very different phænomena in the precipitation of certain metallic ſolutions, as thoſe of venereal Vitriol and corroſive Sublimate.

The pure volatile Salt or Spirit of Sal ammoniac may be rendered perfectly ſimilar to thoſe of any particular animal matter, by adding a ſmall portion of the Oil of the ſubject whoſe Salt or Spirit is to be imitated, and combining them together by digeſtion, ſublimation, or diſtillation.

Their general properties.

WITH regard to the properties of volatile Salts, they poſſeſs the general characters of alcaleſcence in common with the fixed alcalies, as changing Syrup of Violets green, eſſerveſcing with acids, and precipitating ſubſtances diſſolved in them (*k*).

They

(*k*) *Volatile alcalies precipitate ſubſtances diſſolved in acids like the fixed.*] This rule is much leſs general, and the effects of volatile and fixed alcalies are in theſe reſpects, at leaſt in regard to metallic ſolutions, more different from one another, than has been commonly ſuppoſed.

Thus though Gold, diſſolved in Aqua regis, is precipitated by volatile alcalies, when only a certain quantity of the Alcali has been added, equally as by the fixed; yet on adding a larger quantity of the volatile Alcali, great part of the precipitated Gold is taken up again, whilſt the fixed, in whatever quantity it is employed, rediſſolves none: The Precipitate made by volatile alcalies fulminates with violence on being expoſed to a ſmall degree of heat, whilſt that made by the fixed [illegible] there was previouſly a volatile one in the menſtruum, [illegible] is the caſe when the Aqua regis is prepared with Sal ammoniac), bears to be ignited, and melted into Gold again, without the leaſt exploſion.

In like manner, Silver and Biſmuth diſſolved in Aqua fortis, and Copper in all acids, are totally and permanently precipitated by fixed alcalies; but either not precipitated at all, or readily diſſolved again by the volatile. Solution of Platina in Aqua regis is not precipitated totally, and ſolution of Zinc in Aqua fortis is ſcarcely precipitated at all, by either Alcali.

Mr. Marggraf has given ſome curious experiments on this ſubject, in the Memoirs of the Academy of Sciences of Berlin for the year 1745. He finds that volatile ſpirits (it was the common Spirit of Sal ammoniac he

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They form with the acid a neutral Salt, which readily concretes upon duly evaporating the liquor, into a cryſtalline form, and which requires a conſiderable heat to make it ſublime, whilſt the volatile alcalies by themſelves exhale even on the warm hand. Theſe neutral compounds are called by the general name of *Ammoniacal Salts*; common Sal ammoniac being the principal of them, or that which has been the moſt generally known. Of the ammoniacal Salts compoſed of volatile alcalies and the different mineral acids, an account has already been given in the firſt part of this work.

Volatile alcalies have leſs affinity or attraction to acids than fixed alcalies have; fixed alcalies abſorbing the acid from them, on which the volatile Alcali, now ſet at liberty, ariſes with a gentle warmth; and on this principle depends the common method of extracting the volatile Alcali from ammoniacal Salts.

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he made uſe of) not only rediſſolve ſundry metallic bodies after having precipitated them, but diſſolve even the calces thrown down by fixed alcalies, after they have been ſeparated from the liquor, and freed as much as poſſible from their ſaline matter by ablution with hot water.

The calces of Gold, Silver, and Biſmuth, he ſays, diſſolved with eaſe: Thoſe of Tin, Lead and Quickſilver ſeemed to reſiſt theſe menſtrua; the volatile ſpirit having no effect when added in over-proportion to the liquor after precipitation any more than when digeſted on the edulcorated Precipitates.

He obſerves, that the ſolution of Gold in volatile ſpirits depoſites the Gold on being expoſed to the air.. That Silver does not ſeparate from the liquor on ſuch expoſure, but that upon the exhalation of the ſuperfluous moiſture, it ſhoots into fine cryſtals, which diſſolve, by the aſſiſtance of heat, in rectified Spirit of Wine; from which they again concrete in the cold, into elegant cryſtallizations.. That Sea ſalt or its acid throws down Silver from its volatile alcaline ſolution, in form of a white Precipitate, but that the vitriolic acid produces no change.. That Mercury, added to this ſolution, unites with the Silver, and forms with it in a ſhort ſpace of time, the effloreſcences called, *Arbor Dianæ*.

We have formerly ſeen (page 296.) that fixed alcalies impregnated by calcination with the inflammable principle of animal ſubſtances, diſſolve thoſe metals nearly in the ſame manner as the volatile; and perhaps it is on the ſame principle that the diſſolving power of both alcalies in good meaſure depends, for volatile alcalies, however purified, are always found to participate of inflammable matter.. Gold and Silver ſeem to be acted on almoſt equally by both kinds of Alcali: Zinc diſſolves moſt readily in the fixed, and Biſmuth in the volatile: Quickſilver, though it reſiſts the volatile, diſſolves in the fixed, whilſt Lead and Tin ſeem to reſiſt both. There are ſome remarkable differences in the ſolutions made by the two kinds of Alcali: Thus the marine acid, which precipitates Silver from the volatile, occaſions no change in the ſolution of that metal made in the fixed Alcali.

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Chalks and other calcareous earths likewiſe abſorb the acid from them when the mixture is expoſed to a conſiderable heat, the acid ſeeming to have a ſtronger attraction to the earth than to the volatile Alcali already combined with it. On varying the manner of application, the affinity ſeems to be juſt the reverſe: Diſſolve the Chalk firſt in any acid, and the addition of a volatile Alcali will precipitate it; as if the acid had the greateſt affinity to one by dry mixture in the fire, and to the other in the way of humid ſolution. The remarkable habitude of theſe Salts to Quicklime has been examined in another place. (See Vol. I.)

Volatile Salts diſſolve in about four times their quantity of water; and make the liquor ſenſibly colder; whereas fixed alcalies render it ſomewhat warmer. On diſtilling the ſolution, the Salt condenſes about the ſides of the recipient in a cryſtalline form, uſually arranged into different ramifications, which ſome of the chemiſts have fancifully reſembled to the original horns of the Hart from which theſe kinds of Salts have been principally prepared.

Rectified Spirit of Wine has very little action on theſe Salts. If this Spirit be added to a ſaturated ſolution of volatile Salt made in water, it weakens the diſſolving power of that menſtruum, and a proportionable quantity of the Salt precipitates (*l*). Oils and

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(*l*) *Volatile alcalies precipitated from water by Spirit of Wine.*] This property affords a commodious method of diſtinguiſhing an abuſe, which *has been often* practiſed in trade, in regard to volatile ſpirits; namely, that of diluting them with a large quantity of water, and ſupplying the pungency, thus weakened, by the addition of a little of the penetrating cauſtic ſpirit made from Sal ammoniac or Urine with Quick-lime.

On mixing rectified Spirit of Wine with a genuine volatile ſpirit ſaturated with Salt, a part of the Salt inſtantly ſeparates in form of ſmall cryſtalline concretions; whereas the ſophiſticated ſpirits, containing little or no actual Salt, can exhibit no ſuch appearance.

Some have practiſed an impoſition, which, though of a groſſer kind, eludes this method of trial. A ſolution of crude Sal ammoniac being mixed with a ſolution of Pot-aſh, the Pot-aſh abſorbs the acid of the Sal ammoniac, and ſets its volatile Alcali at liberty; and thus the liquor (eſpecially if acuated with a little of the ſpirit made with Quicklime) acquires the ſame pungent ſmell with that of the pure diſtilled volatile ſpirits.

As this liquor contains a quantity of regenerated Sea-ſalt (compoſed of the Pot-aſh and the marine acid of the Sal ammoniac) and as this

VOLATILE SALTS.

and Balſams unite with volatile alcalies by agitation into a ſemiſaponaceous liquid; eſſential Oils eaſily, the expreſſed difficultly.

Volatile ſpirits, or ſolutions of volatile Salts in water, diſſolve ſome metallic bodies, particularly Copper. Added to a ſolution of this metal made in acids, they precipitate a part, but ſoon take it up again, and render the liquor of a beautiful ſapphire-blue colour. Added to a ſolution of Mercury-ſublimate, they throw down the Mercury in form of a white powder. This laſt property is one of the common criteria for diſtinguiſhing a volatile Alcali in liquors from a fixt; the latter throwing down from the ſolution of Sublimate, not a white, but an orange-yellow or reddiſh Precipitate.

Volatile ſpirits are leſs active menſtrua for ſundry vegetable and animal ſubſtances, and for Sulphur in the mineral kingdom, than fixt alcaline Lixivia. This may be aſcribed in great part to their volatility; which renders them incapable of bearing the boiling heat that is in many caſes neceſſary for enabling fixt alcalies to act effectually.

Volatile Salts, mixed with Nitre and injected into a red-hot crucible, deflagrate and are deſtroyed. This experiment, which ſucceeds with the pure volatile Alcali of Sal ammoniac, as well as with thoſe which have a manifeſt impregnation of Oil, evinces that theſe Salts contain an actual inflammable matter as one of their eſſential principles; and agreeably to this, it may be obſerved, that no volatile Alcali is producible but from ſubſtances that participate of

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[illegible] diſſoluble in Spirit of Wine, it is plain that the counterfeit, on being mixed with that ſpirit, will ſuffer the ſame precipitation that the genuine volatile ſpirits do.

This abuſe may be diſcovered by evaporation, the genuine totally exhaling, whilſt the counterfeit leave a fixed Salt behind; or more readily, by adding to a little of the ſuſpected ſpirit, a drop or two of a ſolution of Silver made in Aqua fortis. This ſolution, as I have found on trial, mingles uniformly with pure volatile ſpirits, without producing the leaſt precipitation or turbidneſs, or untranſparency; whereas, if the ſpirit contains the ſmalleſt portion of Sal ammoniac, or Sea-ſalt, or regenerated Sea-ſalt, the two liquors grow white and milky the inſtant they are mixed. The foundation of this experiment is obvious from the foregoing note.

VOLATILE SALTS.

phlogiſton. They apparently contain alſo an earth; but what other principle or principles enter their compoſition, experiment has not hitherto determined.

II. LATENT ANIMAL ACID.

ACID.

THIS acid, which has eſcaped the enquiries of many of the chemiſts, and whoſe exiſtence has even been denied, Mr. Homberg has ſhewn two ways of procuring.

One way is, by concentrating the phlegm which ariſes firſt in the common diſtillation of animal ſubſtances for their volatile Salt and Oil. This phlegmatic liquor being collected by itſelf, and rediſtilled with a gentle heat till only a ſmall portion remains, he finds the acid in this reſiduum; which acid he has ſometimes concentrated ſo far, that it ſeemed as ſtrong as common Vinegar. If the quantity of phlegm obtained in the firſt diſtillation is ſmall, it gives when concentrated only ſlight marks of acidity; where the quantity is greater, the acidity alſo is ſtronger, though in either caſe it is ſufficiently ſenſible.

The other method of collecting this latent acid is, by mixing earthy matters with the animal ſubject at firſt, and urging the diſtillation after all the alcaline Salt and Oil have ariſen. In this caſe, the acid does not come over with the phlegm, but in the liquor forced out at laſt by the greateſt vehemence of fire.

The nature and properties of this animal acid we do not know; nor is it certain that the acids obtained by the two proceſſes above mentioned are entirely the ſame. Perhaps this acid may be no other than a part of the vegetable acid of the food, which has eſcaped the digeſtive powers of the animal; for it is diſcovered moſt remarkably in the blood, bones, *&c.* of thoſe animals who feed immediately on vegetables (*m*).

III. ANI-

(*m*) *Latent acid*] Mr. Pott informs us (in the *Miſcellanea Berolinenſia*, *tom.* vi. *Ann.* 1740) that the ſaline empyreumatic ſpirit, which comes over laſt in the common diſtillation of animal ſubſtances by an intenſe fire, leaves, on being rectified, an ammoniacal liquor, and that the liquor which ariſes in the rectification is alſo ammoniacal: For on the addition of a fixt Alcali, it diffuſes a ſtrong urinous ſmell, which was diſ-

coverable

§ III. ANIMAL OILS.

OILS.

THE Oils which ariſe in the diſtillation of animal ſubſtances have a ſtrong peculiar ſtench. Diſtilled a ſecond time in glaſs retorts, by a gradual fire, they leave behind a thick, black, pitchy matter, and thus become more fluid and leſs fetid. By repeated diſtillations, either by themſelves or with the addition of Quick-lime or other earthy powders to detain more effectually the groſs ſubſtance, their quantity is more and more diminiſhed, and their empyreumatic ſmell more and more deſtroyed; they become thin, colourleſs, of a ſweet taſte, and a grateful penetrating odour.

It is obſervable that theſe Oils diſſolve in Spirit of Wine, both when ſubtilized by theſe operations, and in their groſs fetid ſtate, though the animal ſubject that affords in diſtillation a large quantity of the Oil, if treated at firſt with ſpirit, gives out little, or ſcarcely any thing, to that menſtruum. We ſhall ſee hereafter that it is ſtrictly the gelatinous matter of animals that yields theſe offenſive Oils; and of this matter the proper diſſolvent is not ſpirit, but water.

Dippel, who firſt diſcovered the purification and ſubtilization of empyreumatic animal Oils by repeated diſtillations, recommends the Oils ſo rectified as medicines of great virtue. Theſe Oils, in effect, appear to poſſeſs a high degree of medicinal activity: Hoffman relates, that two drops being diſſolved in half an ounce of rectified Spirit of Wine, and the ſolution given to four men, (that is, only half a drop

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coverable only in a low degree before; and the Alcali ſhoots into cryſtals, a mark that it has abſorbed an acid. By this method, he ſays, an acid principle may be demonſtrated in all the parts of animals. He obſerves likewiſe, that the Caput mortuum or coal remaining after the diſtillation of blood, yields on being diſtilled with Vitriol or Bole, an acid ſpirit agreeing in all reſpects with that of *common Salt*; and this though the animal uſes no common Salt in its food.

[*] May it not be preſumed, that the acid diſcoverable in animal ſubſtances by theſe kinds of operations, is really no other than the acid of the marine Salt which we have elſewhere ſeen that thoſe ſubſtances participate of?

OILS. to each) this ſmall quantity procured in them all a copious ſweat (*n*).

The empyreumatic Oils diſtilled from different animal ſubſtances, are not entirely the ſame like the volatile Salts: Of many of them, the ſmell is very obviouſly different, not only in degree but in kind. Their particular properties have as yet been very little examined, few experiments having been made upon theſe fetid ſubſtances, except by thoſe who have buſied themſelves in ſearching for alchemical myſteries in the excremental parts of animals. Whether by rectification they all become perfectly ſimilar, as volatile Salts do is unknown.

Animal Oils differ greatly and obviouſly from the vegetable; and even the inflammable matter which remains fixed in the black coal left in the diſtillation, after the expulſion of all the Oil that the greateſt vehemence of fire is capable of expelling in cloſe veſſels, appears to be different in the two kingdoms. Fixed alcaline Salts, calcined with coals, extract a part of this inflammable matter, and render it ſoluble along with themſelves in water: animal coals have this particularity, that when the Alcali has been calcined with theſe, the ſolution precipitates from a ſolution of green Vitriol the pigment called Pruſſian-blue, and has different effects on other metallic ſolutions alſo from other kinds of alcaline Ley.

IV. ANIMAL EARTH.

EARTH. ANIMAL ſubſtances, or the black coal remaing after the diſtillation of them, on being burnt with a ſtrong fire in open veſſels, are diveſted of all their volatile and combuſtible matter, and

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(*n*) *Animal Oils of great medicinal activity.*] It is in conſequence of the virtue of the Oil, that volatile animal ſpirits differ as medicines from the pure Spirit of Sal ammoniac. In the rectification of animal ſpirits for medicinal uſe, the intention is not to purify them wholly from the Oil, but to ſeparate the groſſer part, and ſubtilize the reſt, and thus bring it towards the ſame ſtate as when the Oil is rectified by itſelf. I have repeated the rectification of Spirit of Hartſhorn twenty times ſucceſſively, and found it ſtill to participate of Oil, but of an Oil very different from what it was in the firſt diſtillations.

reduced

EARTH.

reduced into a white earth. The hard parts, as bones and horns, ſtill retain their original figure; and inſtead of falling into aſhes, like vegetable matters, preſerve ſome degree of hardneſs: Hence their thorough calcination is more difficult than that of vegetables, the external part of the maſs defending the internal from the air.

The properties of the earths obtained by this proceſs from animal and vegetable ſubſtances have been little examined. Thus much however, the experiments that have been made upon them, are ſufficient to demonſtrate, that the earths of the two kingdoms are of a quite different nature from one another. Their differences are moſt remarkable in their habitude to vitrification.

The vegetable earth vitrifies with eaſe, and gives a green tinge to its glaſs which ſometimes is very beautiful. The animal earth is extremely refractory, and is ſcarcely at all to be brought into perfect fuſion, in the common furnaces at leaſt, by the moſt active fluxes: When mixed with the vegetable earth, or with different vitrious fluxes, in ſuch quantity as not to prevent the fuſion of the flux, it gives an opake milkineſs to the glaſs, like that of fine porcelane, or white enamal; the animal calx ſeeming to be only diffuſed through the maſs without alteration of its form, juſt as it would be diffuſed through water by agitation. From this property of animal earths, they are employed in the compoſition of milk-white or porcelane-like glaſſes (*o*).

SECT.

(*o*) *Animal earths.*] In the animal kingdom we meet with three kinds of earth, apparently diſtinct from one another.

1. The earth of the *Shells of ſea-fiſhes* appears to be nearly of the ſame kind with Chalk and the mineral calcarious earths. By calcination, it is changed into a true Quick-lime, in ſome reſpects ſtronger than the mineral Limes. It diſſolves readily and perfectly in the nitrous, marine and vegetable acids; but not at all, or only in an inconſiderable quantity, in the vitriolic. When previouſly diſſolved in other acids, it is precipitated on the addition of the vitriolic, into a concrete, no longer diſſoluble in any, and which is found to be ſimilar to the Selenitæ which the mineral calcareous earths produce upon the ſame treatment. This earth is extremely refractory in the fire: It does not perfectly vitrify (at leaſt if its proportion is conſiderable) either with Salts or with metallic glaſſes; and in this reſpect it differs from the calcareous earths of the mineral kingdom.

The

SECT. III.

INSECTS.

INSECTS.

AMONG the infinite variety of inſects, generated ſo abundantly in the different parts of nature, on vegetables, on the bodies of larger animals, in putrid vegetable and animal ſubſtances, and in the earth; there are few which have hitherto being chemically examined, or applied to any conſiderable uſes, in medicine or in arts. The principal are, Cantharides, Ants, Earth-worms, Millepedes, and Cochineal.

I. CANTHARIDES.

CANTHARIDES are a beautiful kind of fly or winged inſect, of a bright, ſhining, greeniſh-golden

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2. The Aſhes of *Bones* and *Horns* agree with the preceding in being eaſily ſoluble in the nitrous, marine and vegetable acids, and not in the vitriolic, and in their being precipitated by the latter from other acids into a ſelenetic concrete. They agree alſo in their reſiſtance to vitrification: I have tried in vain to vitrify them by the addition of other earths, as well as of ſalts and metallic glaſſes: Fuſible earthy mixtures (See the firſt part of this work) by which all the earthy and ſtony bodies I know of in the mineral kingdom except the precious ſtones, would in certain proportions have been brought into fuſion, were by the ſame and by ſmaller proportions of calcined Hartſhorn and of calcined Bones, either prevented from melting at all, or rendered opake and milky . . . The difference of theſe earths from the preceding, and the only difference I have obſerved, is, that they are not changeable by fire into Lime; How ſtrongly ſoever the earth of Bones and Horns be calcined, it continues inſipid, and gives no manifeſt impregnation to Water.

3. The Aſhes of *Blood*, *Skin*, and *Fleſh*; differ from the earths of the firſt kind in not being convertible into Lime; and from both the firſt and ſecond in being diſſoluble, readily and perfectly and plentifully in the vitriolic acid as well as in the nitrous and marine. In both these reſpects they agree with the incinerated earth of vegetables: They differ from that earth in the nature of the compound which they form with the vitriolic acid, the animal earth diſſolving into [illegible] auſtere aſtringent liquor, approaching to an aluminous nature, the vegetable into a bitter purgative one ſimilar to the purging mineral waters. The habitude of this ſpecies of animal earth to vitrification, I have not tried.

The earth into which animal ſubſtances are reſolved by putrefaction appears to be one and the ſame whatever ſubject it was produced from; and not to differ ſenſibly from vegetable mould. It is indiſſoluble in acids, ſomewhat tenacious when moiſtened with water, friable when dry, and acquires no additional hardneſs in the fire. The habitude of either the vegetable or animal mould to vitrification is not known.

golden

I. CANTHARIDES.

golden colour with ſome admixture of bluiſh. They were formerly brought from Spain, and hence are ſtill commonly called Spaniſh flies. They are not, however, peculiar to that kingdom: France, ſome parts of Germany, and other countries, produce abundance. It is principally in the ſpring, and on poplar and aſh-trees, that they are met with.

The uſual way of killing them is by the ſteam of ſtrong or diſtilled Vinegar (*p*). The flies are put into a clean pot, which is covered with a hair-cloth, and then inverted upon another pot containing the vinegar warmed by a little fire made underneath; the juncture of the two pots being cloſely luted, to confine the ſteam. The flies are afterwards thoroughly dried, and packed up ſecure from the air. In long keeping, they fall by degrees into a greyiſh or browniſh light powder, and in this ſtate are unfit for uſe, their intrinſic qualities periſhing with their external form. The wings are the moſt permanent part, theſe remaining entire after the body of the fly has mouldered into duſt.

Cantharides, when freſh, have a ſtrong fetid ſmell. Taſted they make at firſt no impreſſion upon the tongue, but in a little while they diſcover a degree of acrimony, and a kind of pitchy flavour. Applied to the ſkin, they raiſe a bliſter on the part. The uſual bliſtering plaſters are compoſed of powdered Cantharides and ſome common plaſter, in the proportion of one part of Cantharides to two, ſix, eight, or more of the plaſter, according as the compoſition is required to be more or leſs active.

Taken internally, in the doſe even of a few grains, they generally occaſion violent irritation and inflam-

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(*p*) *Killed by the ſteam of Vinegar.*] Vinegar ſhould ſeem not to be very proper for this uſe, for the ſteam which ariſes from it in a gentle heat can ſcarcely act any otherwiſe upon the inſect than as a watery vapour. Vinous ſpirits, uſed among us for the curation of millepedes, appear to be the beſt calculated for the curation of Cantharides alſo, and of other Inſects, as the colouring ones Kermes and Coccus Polonicus; the ſteam of Spirit of Wine, or the liquor itſelf ſprinkled upon them, not only ſoon killing the inſects but embalming as it were, and preſerving them from decay.

mations. They act in a peculiar manner upon the kidneys, and the urinary and ſeminal veſſels: When applied only externally as a bliſter to remote parts, they often affect the bladder, and bring on a difficulty and pain in making water. They are nevertheleſs given inwardly in ſmall doſes, both with ſafety and advantage, in ſome refractory diſorders, which baffle the force of medicines of leſs activity. Dr. Grœneveld, who was impriſoned, in England, for having ventured to exhibit them, publiſhed a treatiſe in defence of his practice and of the utility of the medicine. He employs Camphor for correcting the virulence of the Cantharidies; but for my own part, I ſhould have little dependance upon that corrector: The beſt remedies againſt the ill effects of this, as of other ſtimulating drugs, are, Milk and expreſſed Oils.

The ſtimulating power of Cantharides is aſcribed by many to an acrimonious cauſtic Salt. But experiment diſcovers in them no ſaline principle of any kind, till they have undergone the deſtructive action of fire. By the action of a ſtrong fire, a volatile alcaline Salt is producible equally from all animal ſubſtances; the ſame Salt, and no other, is obtained from Cantharides. It is pretty remarkable, that thoſe who deduce the virtue of this inſect from an imaginary Salt, employ, for extracting its virtue, not water which is the direct and proper menſtruum of Salts, but vinous ſpirits; and thus, in their practice, contradict their own theory.

Others, in order to account for the ſingular qualities of this inſect, have had recourſe to its mechanic ſtructure; to its ſharp, pointed, needled, ſword-like particles, lacerating the parts of animal bodies which they come in contact with. The microſcope indeed diſcovers ſome fine pointed filaments on the belly of the fly: But theſe are only hairs, too ſoft and flexible to wound or injure the ſkin. Cantharides communicate all their activity to vinous ſpirits, without loſing any thing of their form: Bare pulverization deſtroys their ſpicular appearance, without abating their acrimony or cauſticity. It is not by virtue of their

their mechanic ſtructure, but of their intrinſic properties, that they ſtimulate, lacerate and corrode.

If we may be allowed, in analogy to the vegetable kingdom, to apply the name of *reſinous* to that principle in animal ſubſtances which rectified Spirit of Wine diſſolves; the native principles of Cantharides are, a reſinous, gelatinous, and earthy matter, and the principle in which their activity ſolely and wholly reſides, is the reſin.

Four ounces of the flies, boiled in water, gave two ounces, all but two ſcruples of gelatinous extract: after which rectified Spirit extracted twenty-eight grains of Reſin, the indiſſoluble earthy reſiduum weighing two ounces and one ſcruple. The ſame quantity of the flies, treated firſt with ſpirit, yielded ſix drams two ſcruples of reſinous extract; and afterwards with water three drams twelve grains of a gelatinous one: The reſiduum amounted here to ſix drams more than in the former way of extraction (*q*).

The reſinous extract is acrid and nauſeous to the taſte, and bliſters the ſkin like the fly in ſubſtance; whilſt the gelatinous matter, freed from the reſinous, proves like the earthy part, inſipid and inactive (*r*).

(*q*) *Cantharides with water and ſpirit.*] This inſect communicates nothing of its fine green colour to either of theſe liquors. The watery tincture is of a muddy yellowiſh or browniſh, and the remaining fly appears to have loſt conſiderably of its beauty. The ſpirituous tincture is of a bright yellow, but leaves the Cantharides of brighter and more beautiful colours than they were at firſt.

There are many other animal ſubſtances, that glow with ſuperficial colours, which chemiſtry has not been able to ſeparate or extract. The coloured ſhells and furs, and the plumage of birds give out nothing of their colours to any known menſtruum.

(*r*) *Gelatinous part inactive.*] Though the activity of the Cantharides may be properly ſaid to reſide in that part which Spirit of Wine diſſolves; yet this matter ſeems to be totally extracted by water, as well as by ſpirit; the gelatinous ſubſtance rendering the other ſoluble in water, in the ſame manner as the gummy parts of vegetables do the reſinous. An extract made by water, an extract made by Spirit, and the flies remaining after both proceſſes reduced into fine powder, were applied at the ſame time to the arm of the ſame perſon: The two extracts bliſtered ſo far as could be judged, equally, and as effectually as Cantharides in ſubſtance: The two reſidua were equally inactive; they did not inflame, or irritate, or ſenſibly affect the ſkin, in twenty-four hours.

CANTHARIDES. In diſtillation, rectified ſpirit brings over little or nothing: The diſtilled wather has a conſiderable ſhare of taſte and ſmell, but exhibits no appearance of Oil.

Three ounces of Cantharides diſtilled in a retort in an open fire, gave over one ounce of urinous ſpirit, two drams of empyreumatic Oil, and two drams ten grains of volatile Salt. The Caput Mortuum weighed ten drams; and on being calcined and elixated, yielded ſcarcely a grain of ſaline matter—It is plain from this analyſis, that the acrimony and medicinal activity of Cantharides can have no dependence on the volatile Salt; for we ſhall ſee hereafter, that much larger quantities of Salt are obtainable from ſubſtances entirely inſipid and inactive, as raw Silk, Hair, Feathers, &c.

II. ANTS. THE ANT, noted by the naturaliſt for its agility and induſtry, and its extraordinary care of its eggs as they are called, in conveying them into the ſun ſo often as he ſhines, and as diligently carrying them off upon his diſappearance or on the approach of rain, affords likewiſe ſome remarkable phænomena to the chemical obſerver.

Volatile acid ſmell. On turning up an Ant-hill in ſpring or ſummer, the firſt thing perceived is a ſtrong volatile ſmell, affecting the noſe nearly in the ſame manner as Spirit of Hartſhorn or of Sal ammoniac. This vapour is not, however, as ſome have too haſtily affirmed, ſimilar in quality to thoſe alcaline ſpirits: It is truly of an acid nature, and like the other ſubſtances of that claſs, changes the colour of blue flowers, as Violets, Borage flowers, &c. to a red.

Reſin in Ant-hills. On ſearching the Ant-hill, we commonly find pieces of a reſinous ſubſtance. This was ſuppoſed formerly to poſſeſs peculiar virtues, and diſtinguiſhed by the names of wild Frankincenſe, *Suffimentum ſylveſtre*, *thus Germanicum*, *maſtix & electrum formicarum*. It looks, taſtes, and ſmells, like the common Reſin of the Fir-tree, and in effect it is no other. It is about the roots of old Fir-trees that Ants principally lodge; and it is in ſuch lodgements, that the Reſin is principally met with.

with. For what purpoſe they collect it, I do not pretend to know.

Their food.

I examined, in June, above thirty Ant-hills, but did not at that ſeaſon find any of the corn or grain which they are ſaid to lay up ſo plentifully for winter proviſion. It is not indeed on grain, but on the ſweet juices of vegetables, and the fleſhy parts of animals that they ſeem to feed. A little Honey or Cheeſe, placed near them, will ſoon collect a ſwarm of Ants, and by this method they may be catched in great numbers. They deſtroy ſome kinds of Caterpillars on trees and on culinary plants. If a Mouſe, Frog, or other like animal be placed in an Ant-hill, he will be devoured in a few days to the bones and ligaments.

Exquiſite ſkeletons of ſmall animals.

Hence we are furniſhed with a method of obtaining ſkeletons of thoſe animals, exquiſitely beautiful and perfect, far ſurpaſſing any thing that can be executed by artificial anatomy. The ſubject is for this purpoſe to be incloſed in a wooden box, and properly diſtended, to prevent the parts from collapſing or being cruſhed together by the earth: The box is to be perforated with a number of holes, through which the inſects will preſently find their way.

Acid of Ants.

The pungent vapour obſerved on ſtirring up an Ant-hill, does not proceed from any heterogenous ſubſtances, but from the Ants themſelves. If a parcel of clean, live, vigorous Ants be ſtirred with a rod, ſo as to greatly irritate and exaſperate them, they diſcharge a ſimilar acid juice, which may be plainly ſmelt and taſted upon the ſtick: If they are thus agitated and irritated in a veſſel of water or of Spirit of Wine, they impregnate the liquor with their acidity.

A part of this acid is ſubtile and volatile, a part groſſer and more fixed. The firſt ariſes in diſtillation with rectified Spirit of Wine, the latter not: Thus, if a conſiderable quantity of the ſpirit be gently drawn off from the ſpirituous infuſion, the diſtilled liquor will give ſenſible marks of acidity, but will not be near ſo ſtrongly acid as the remainder; and hence we are enabled to concentrate this animal acid. Water

ANTS. alſo brings over at firſt only the more ſubtile part, but if the diſtillation be protracted, the whole of the acid ariſes at length along with the water, as appears from the following experiment.

Analyſis. I diſtilled in a retort without addition two parcels of Ants; one conſiſted of Ants from which water had been previouſly abſtracted in *balneo mariæ*, and which had afterwards been exſiccated; the other of freſh Ants. Twenty-four ounces of the firſt yielded four ounces and a half of empyreumatic Oil, three ounces and a half of urinous ſpirit, two drams and a half of concrete volatile Salt, one dram of fixed alcaleſcent Salt, and eight ounces of earth, without giving any mark of acidity throughout the whole proceſs. The ſame quantity of freſh Ants on the other hand, gave over firſt of all eleven ounces and two drams of an acid ſpirit, afterwards ſix ounces ſix drams of an urinous one, one ounce and a half of empyreumatic Oil, and a dram and a half of concrete volatile Salt: The remaining earth weighed nearly three ounces, and yielded half a ſcruple of fixed Salt——It is plain from hence, that the acid of Ants is capable of being wholly elevated by diſtillation with water even in *balneo mariæ*.

The groſs acid is as ſtrong as good Vinegar: It changes Syrup of Violets red; efferveſces with alcaline Salts and precipitates ſubſtances diſſolved by them; diſſolves abſorbent Earths, Iron and ſeveral other metallic bodies.

Mr. Hook obſerves that ſome other inſects which are furniſhed with ſtings, as Bees, Waſps, Hornets, are furniſhed alſo with an acid juice which they diſcharge upon being irritated; but none yield ſo large a quantity as Ants. Ants in their *chryſalis* or maggot ſtate have no acid; no marks of any having been diſcovered on diſtilling a quantity of the eggs.

Eſſential Oil. Another very extraordinary phænomenon occurred in a chemical examination of this inſect. Having diſtilled off ſome rectified Spirit of Wine from a quantity of Ants, and cohobated the ſpirit upon two or three

three freſh parcels, I found ſwimming upon the diſtilled liquor, a fine, clear, eſſential Oil.

Eſſential Oils are extreme rarities in the animal kingdom: There are only ſome ſubſtances of the unctuous kind that yield any thing like one: The Oils obtained from theſe are rather thin Fats than true Oils; and ſuch as they are, they do not ariſe without a conſiderable fire, whilſt this Oil came over with highly rectified ſpirit in the heat of a water bath. I ſuſpected therefore that it was no animal Oil; that it proceeded from ſome ſmall bits of wood or of the reſinous ſubſtance above-mentioned, from which the Ants had not been ſufficiently cleanſed. The ſmell and taſte ſeemed likely to determine this; and here again I was ſurprized, to find that it had nothing of the pungency or heat which accompanies the Oils of Reſins and Woods. For further certainty in this point, I made a freſh diſtillation from Ants very carefully picked, and well waſhed with ſpirit: I diſtilled alſo ſome ounces of the Reſin with Spirit, in the heat of a water bath, after the ſame manner as the Ants. The Ants yielded as before an eſſential Oil, whilſt the Reſin gave over ſome flavour to the ſpirit, but no viſible Oil. It was now evident, that the Oil did not proceed from heterogeneous matters adhering to the Ants: But there was ſtill a poſſibility that it did not pre-exiſt in the inſect. When Spirit of Wine is diſtilled with the vitriolic acid, an Oil is extricated from the ſpirit: It was poſſible that the acid of Ants might have here produced a ſimilar effect. I therefore diſtilled another parcel of well cleanſed Ants, with pure water inſtead of ſpirit: The experiment was fully deciſive: I ſtill obtained the ſame Oil, a truly animal eſſential Oil (*s*).

(*s*) *Eſſential Oil and acid of Ants.*] Mr. Marggraf, in the Berlin Memoirs for the year 1749, has given ſome further obſervations on theſe ſingular products, and diſcovered alſo another principle in the Ant, no leſs rare in the animal kingdom, an Oil of the expreſſible kind, ſimilar to the expreſſed Oils of vegetables.

A quantity of live Ants was put into water, and diſtilled in a glaſs retort with a fire gradually raiſed to ebullition: In the receiver was found an acidulous liquor, with an eſſential Oil ſwimming upon it, as diſcovered by Neumann. This Oil had a peculiar ſmell, but no burning taſte: Mixed and digeſted with Salt of Tartar, and with iron filings, it

ANTS.

Ants have been employed medicinally as an ingredient in baths for weakneſs of the nerves, rheumatic, paralytic,

gave no mark of acidity: It totally diſſolved the ſolid Phoſphorus of Urine, but without becoming luminous: It united with Spirit of Wine, that had been diſtilled from fixed alcaline Salt, but did not mingle with a ſpirit rectified *per ſe*.

The acid decoction, which remained in the retort, being preſſed out from the Ants, there appeared upon its ſurface an oily matter; the quantity of which was found, in repetitions of the experiment, to be at leaſt an ounce and a half or two ounces from ſix quarts of Ants. This Oil was of a reddiſh-brown colour, and ſmelt a little of the inſect: In a temperate air it appeared fluid and tranſparent, but in a moderate froſt it became thick and opake: Like other expreſſed Oils, it burnt with a wick; ſwam on water, and refuſed to mingle with it; did not unite with the moſt highly rectified Spirit of Wine; did not ariſe in diſtillation with water; diſſolved Sulphur by boiling; formed a plaſter with calx of Lead, and a perfect Sope with alcaline Salts.

The acid decoction, freed from the Oil, was diſtilled in a retort placed in ſand: The receiver was changed as ſoon as the drops came over very acid; and the proceſs diſcontinued as ſoon as they became empyreumatic. By this means was obtained a liquor both in ſmell and taſte highly acid; the thick, black Caput mortuum remaining alſo conſiderably ſo.

Properties of the acid of ANTS.

THE acid of Ants efferveſces with alcaline Salts, both fixed and volatile. With volatile alcalies it forms a neutral liquor, which (like that compoſed of the ſame alcalies and Vinegar) yields no concrete Salt in diſtillation.

With fixed alcalies it concretes, upon proper exhalation, into oblong cryſtals, which deliquiate in the air. The cryſtals, or the ſaturated neutral liquor uncryſtalized, on being diſtilled with a fire increaſed till the retort begun to melt, yielded a liquor ſcarce ſenſibly acid, and afterwards a ſmall quantity of an urinous and partly ammoniacal liquor. The remaining black matter, diſſolved in diſtilled water, filtered and evaporated, ſhot into large cryſtals, of a particular figure, and which did not liquefy in the air, though they were in taſte ſtrongly alcaline, efferveſced with acids, and had all the other properties by which fixed alcalies are diſtinguiſhed.

This acid diſſolves, with great efferveſcence, Coral, Chalk, and Quicklime; and concretes with them all into cryſtals, which do not deliquiate in the air.

It does not precipitate Silver, Lead or Mercury from the nitrous acid; nor Quick-lime from the marine. Hence it appears to have no analogy to the marine or vitriolic acids; the firſt of which conſtantly precipitates the metallic ſolutions, and the other the earthy.

It does not act upon filings of Silver; but (like vegetable acids) it totally diſſolves, by the aſſiſtance of heat, the calx of Silver precipitated from Aqua fortis by Salt of Tartar.

It does not diſſolve calces of Mercury, (as vegetable acids do) but revives them into running Quickſilver.

paralytic, and other like complaints. Vinous ſpirits, impregnated by diſtillation with their volatile parts, have been applied externally to the ſame purpoſes, and likewiſe taken internally, as attenuants, corroborants, and aphrodiſiacs. Many other preparations of this inſect for the like uſes are deſcribed in the old books of pharmacy.

Deſtroyed.

Ants are deſtroyed by ſtrewing a good quantity of unſlaked Lime about their hills: Some make uſe of Quickſilver, as a general poiſon to inſects. It is ſaid that they fly from Chalk, and from Ants that have been burnt; but on trial, I could not find that they did.

III. EARTH-WORMS.

EARTH-WORMS are inhabitantants of moiſt fat grounds, and are rarely or never ſeen in dry ſands: After rains they come up to the ſurface, to enjoy the moiſture, and there they often fall a delicious prey to different kinds of birds (t). It is only when the ſur-

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It acts very weakly upon filings of Copper, but perfectly diſſolves Copper that has been calcined. The ſolution yields beautiful, compact, green cryſtals.

It diſſolves iron filings with violence. The ſolution duly evaporated, ſhoots into cryſtals, more readily than that made in diſtilled Vinegar.

It ſcarcely acts at all upon calces or filings of Tin.

It does not, according to Mr. Marggraf, corrode filings of Lead; but diſſolves by the aſſiſtance of heat, the red calx of Lead. The ſolution cryſtallizes into a *Saccharum ſaturni*—In Mr. Ray's philoſophical letters it is ſaid, that "*Lead* put into the acid ſpirit, or fair water together with "the animals themſelves being alive, makes a good *Saccharum ſaturni*," and that this Saccharum on being diſtilled "will afford the ſame acid "ſpirit again, which the *Saccharum ſaturni* made with Vinegar will not "do, but returns an inflammable Oil with water, but nothing that is "acid: And *Saccharum ſaturni* made with Spirit of Verdegris doth the "ſame in this reſpect with Spirit of Piſmires."

It diſſolves Zinc with vehemence; and ſhoots upon duly evaporating the ſolution, into inelegant cryſtals, not at all like thoſe produced with diſtilled Vinegar.

It ſeems to have little effect upon Biſmuth or Regulus of Antimony, either in their metallic form, or when reduced into calces.

From theſe experiments it appears, that this acid has a great analogy with that of Vinegar, though in ſome reſpects it is different.

(t) *Earth-worms as food for birds.*] Mr. de Reaumur propoſes the collecting of Earth-worms for feeding domeſtic fowls, in the room of grain. He computes, that the quantity of Worms lodged in the earth is greater than the ſum total of every kind of grain reaped by men. He obſerves, that during the whole courſe of the year they make greateſt part of the food of numerous kinds of birds, many of which have in winter ſcarcely any other reſource; and that there would ſtill remain enough for the wild birds, if we were to give all our domeſtic fowls no other aliment.

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face of the earth is moiſtened by artificial watering, by rain, or the dew in ſummer-evenings, that we catch them: Some employ for watering the ground a decoction of Hemp-ſeed or of Walnut-leaves: The Worms have great ſenſibility of any motion of the earth about them from a rude approach, and in the twinkling of an eye are ſunk into their holes again. They can ſcarcely bear any ſaline ſubſtances, except thoſe of the nitrous and urinous kind: A ſolution of Vitriol, or of common Salt, or alcaline Ley, poured into their holes kills them; but that nitrous and putrid matters are not offenſive to them, appears from their loving dunghills. * Their food is the young and the corrupted roots of plants.

Earth-worms are cleanſed for medicinal uſe or chemical experiments, by waſhing, and then ſuffering them to creep through coarſe woolen cloths. Unleſs haſtily dried, by the heat of the ſun or of common fire, they are very apt to putrefy on account of their copious ſlimy juice. Moiſtened with Wine or with vinous ſpirits to prevent their putrefaction, and ſet in a cellar in a wide-mouthed glaſs, they are almoſt wholly reſolved in a few days, into a ſlimy liquor. Stahl ſuppoſes that they are impregnated with a nitrous Salt, which they receive from the putrid matters they live among: When the liquamen or diſſolution of the Worms is mixed with a little fixed alcaline Salt, and after due evaporation ſet by to ſhoot, the cryſtals are no other than Saltpetre.

On digeſting dried Earth-worms in freſh parcels of rectified Spirit of Wine, ſo long as they communicated any tinge to the menſtruum, and then inſpiſſating the tinctures together by a gentle heat, I obtained, from four ounces of the Worms, ſix drams of extract: The reſiduum dried and treated with water, gave out three drams and a ſcruple. The ſame quantity of the dry Worms, treated at firſt with water, yielded one ounce ſix drams and a ſcruple; after which, rectified ſpirit extracted two ſcruples. So that the quantity extracted by water is not only greater than by rectified ſpirit, but the collective quantity ex-

tracted

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tracted by both menſtrua is greater when water than when ſpirit is applied firſt.

Thirty two ounces of dried Earth-worms, diſtilled in a retort without addition, by an open fire, yielded thirteen ounces and a half of volatile urinous ſpirit, one ounce of concrete volatile Salt, and four ounces and a half of empyreumatic Oil: The remainder, burnt in the open air, and elixated with water, gave an ounce and a half of fixed alcaline Salt: The earthy part weighed ſix ounces and a half. If the inſects be putrefied previous to the diſtillation, they give over almoſt mere phlegm, or only a very little Oil and volatile Salt.

Earth-worms are ſuppoſed by ſome phyſicians to be antiſpaſmodic and diuretic. In caſes where ſuch medicines are required, they have been given in powder, from fifteen grains to a ſcruple. What medicinal virtues they really poſſeſs, it is not my province to enquire; but whatever theſe virtues may be, it is in the fixed and not in the volatile parts that they reſide: The diſtilled water and ſpirit, though greatly recommended by ſome, are entirely inſignificant, as having no impregnation from the Worms.

Earth-worms burnt to blackneſs in a cloſe veſſel, are ſaid to be more ſerviceable in nervous caſes, than in their natural ſtate, or than ſuch preparations of them as have not ſuffered a like change from fire; and ſundry other animal ſubſtances, prepared in the ſame manner, are ſuppoſed to acquire ſimilar antepileptic virtues. Theſe kinds of preparations are not to be conſidered as poſſeſſing any of the ſpecific qualities of the ſubject from which they were made; but as an animal coal, not diveſted of thoſe principles which a longer continuance of the fire would have more completely formed and extricated from it. The medicinal effects of ſuch a coal, in which the volatile Salt is juſt as it were a forming, are not perhaps much known, any more than its chemical properties.

IV.
MILLE-PEDES.

MILLEPEDES or Woodlice are oblong inſects, commonly as long again as they are broad; flat and whitiſh on the belly; ſomewhat convex, and of a paler

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or darker brown colour on the back, and indented about the ſides like a ſaw. The number of feet; though their uſual Latin name *Millepedes* expreſſes their having a thouſand, is only fourteen, ſeven of which are on one ſide, and as many on the other. The back is compoſed of joints like a Lobſter's tail; by means of which, the animal contracts itſelf into a globular form on being touched, or on the apprehenſion of any danger. The eggs are white and gliſtening, like little pearls.

They are met with in moiſt places, as in cellars, about old rotten wood, about water-troughs, under timber and ſtones that have lain long on the ground unmoved. Their ſize is different in different places and countries: Thoſe found about houſes are larger than in the cavities of trees in woods, and thoſe of France larger than thoſe of Germany: The largeſt are the beſt. Snakes, Lizards, Frogs and Toads devour them.

Watery liquors extract from this inſect, as from the foregoing, conſiderably more than ſpirituous ones; though the quantity of matter, ſoluble in either, is not near ſo large in the Wood-louſe as in the Earthworm. From an ounce of Millepedes I obtained by water four ſcruples and fifteen grains of extract, whilſt the ſame quantity, treated with rectified ſpirit, gave but two ſcruples and twelve grains. After the ſpirit would extract no more, water took up two ſcruples and five grains: But the Millepedes that had been firſt digeſted with water, gave out to ſpirit only half a ſcruple. The indiſſoluble matter, remaining after the action of both menſtrua, weighed when ſpirit was applied firſt, ſix drams four grains; when water was firſt applied, five drams and a half.

Four ounces of Millepedes, diſtilled in a retort with an open fire, gave over ten drams and a half of urinous ſpirit, three drams and a half of empyreumatic Oil, and a ſcruple of concrete volatile Salt: From the remaining coal, burnt in the open air, and elixated with water, were obtained three ſcruples and a half of fixed alcaline Salt, and two ounces of earth. A little

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more volatile Salt may be ſeparated from the ſpirit: But the quantity does not, in all, amount to near ſo much as Lemery makes it: If no miſtake was made in his experiment, the Millipedes of France muſt be different in quality from thoſe of Germany which I examined.

It is commonly ſuppoſed that this inſect contains a nitrous Salt, from its living in cellars, and other places imagined to be impregnated with Nitre. No ſuch Salt, however, is to be diſcovered by experiment, either in the Millipedes themſelves, or in the earths where they are found.

Millepedes are celebrated medicinally as reſolvents and diuretics; and ſuppoſed to have this peculiar advantage, that whilſt they effectually promote urine and attenuate viſcid juices, they occaſion no immoderate heat or exagitation of the humours: It may be queſtioned, perhaps, whether this quality is deduced from fair experience, or from the conceit of their being impregnated with a nitrous Salt.

The powder of Millepedes is ſaid to be leſs efficacious than the freſh inſect, or its juice, or an infuſion of it in Wine or in vinous ſpirits. Whatever the Millepedes may loſe in being dried and powdered, it is pretty clear that nothing of their virtue ariſes in diſtillation; for neither the diſtilled water nor ſpirit have any ſmell or taſte.

V. COCHINEAL. Its general hiſtory.

COCHINEAL is a ſmall, irregular, roundiſh body, internally of a red colour. It is brought chiefly from New Spain, and there collected from a plant, which is now common in the botanic gardens of Europe, called *Opuntia* or prickly Pear-tree.

It was formerly ſuppoſed to be the entire fruit or berry of the tree, wrinkled and ſhrivelled by drying: When the Pear itſelf became known, Cochineal was ſuppoſed to be its ſeeds; but it differs greatly from theſe alſo, as well as from the entire Pear. It is now known with certainty, to be not a vegetable but an animal ſubſtance; to be a particular ſpecies of inſect, produced upon the tree. Acoſta was one of the firſt eye-witneſſes of its being an inſect; and Sir Hans Sloane, COCHI-NEAL.

Sloane, Plumier, and all the later travellers into America, confirm his account.

To what claſs of inſects Cochineal belongs, has been diſputed; ſome affirming that it has ſix feet, and no wings, and reſembles a Bug; others, that it has four wings, and is a ſpecies of *Scarabæus* or Lady-bird; others, that like ſeveral kinds of Caterpillars and Worms, it has neither wings nor feet; and others, that it is an inſect in its imperfect or *chryſalis* ſtate, incloſed in a pellicle or huſk. All theſe opinions are in part true: The Cochineal inſect, like many others, goes through a variety of forms; though the rich red colour, for which it is valued, it poſſeſſes only in one of them. On examining carefully ſeveral hundred weights of Cochineal as brought to us, I have ſeen ſome grains in all the ſtates above-mentioned.

In its advanced ſtate, it is a ſmall ſcarabæus, or ſheath-winged inſect with ſix feet: The body is roundiſh, hemiſpherical on the upper part, flat underneath, full of circles or rings, of a blackiſh-brown colour: The covers of the wings are red, with a yellow ſpot on each. The ſcarabæus depoſites on the leaves of the Opuntia, ſmall eggs, from each of which comes forth a little inſect, reſembled to a Flea or Tick. When this increaſes, it looks like a Worm or Caterpillar, with ſix ſmall feet, ſcarcely to be ſeen, on the forepart of its body: It crawls among the leaves, and chuſes ſuch ſituations, where it may be beſt ſecured from rain and other inclemencies of weather. After theſe have attained to their full growth, they contract themſelves, and at the ſame time become redder and redder: A pellicle is formed all over them, and they adhere motionleſs, as if fixed with Glue, upon the leaves, which now look as if covered with fine red berries. This ſtate continues about ten or twelve days, when the huſk opens, and diſcovers a winged ſcarabæus again, which has very little of the deep red colour of the Maggot or *chryſalis*. The ſcarabæus lays its eggs, and then ſucceed the ſame transformations as before.

Cochineal.

Great care is taken in the preſervation and curation of theſe valuable inſects; in defending them from rain, cold, heat, from being preyed on by birds, &c. in houſing them at certain ſeaſons, and in collecting and drying them for uſe: The particular methods, followed for theſe purpoſes, are not certainly known.

The inſect is doubtleſs collected in its red imperfect Maggot-ſtate; and hence the grains of Cochineal, as brought to us, have rarely any appearance either of feet or wings: If taken whilſt ſome of them are ſtill crawling about, or if the collection is deferred till ſome of them are transformed into winged ſcarabæi, the quality of the Cochineal is debaſed in proportion to ſuch admixture. Some report, that the berries, as they are called, are taken off from the leaves by means of certain inſtruments; but how the ſkins or huſks are ſeparated, we have no account. In the Philoſophical Tranſactions, N° 193, it is ſaid, that a ſmoky fire is made on the windward-ſide of the tree; and that the inſects, killed by the ſmoke, fall ſpontaneouſly or are eaſily ſhaken off, upon linen ſheets ſpread underneath, and are afterwards dried in the ſun. Ruieſcher mentions three ways of killing them; one by hot water, which renders them brown on the outſide; another, on hot iron ſhovels, which ſcorch them to a blackiſh hue; and the third in ovens, where they acquire aſh-coloured variegations. Others report, that after they have been killed by the ſteam of hot water, hot aſhes are ſtrewed upon them, and that the white colour is owing to theſe: There is no probability of this; for I have myſelf taken ſeveral of the grains out of their external involucrum or huſk, and found them naturally ſtreaked with white; beſides that this whiteneſs is greater than that of aſhes, and is not to be rubbed off, as aſhes externally adhering would be.

Freſh Cochineal loſes in drying about two thirds of its weight: I have made the experiment with from three to four pounds, which by drying were reduced to ſixteen and eighteen ounces.

The

COCHINEAL.

Different ſorts.

The dried Cochineal is ſorted into large entire grains, and ſmall or broken ones: The firſt are called by the Spaniards *Grana*, the latter *Granilla*. In trade four ſorts are diſtinguiſhed, *Meſteque*, *Campeſchane*, *Tetreſchale*, and *Sylveſter*; of which the firſt is accounted the beſt and the laſt the worſt: The three former are named from the places where they are produced; the latter, from its being found wild, without any culture. The differences in the cultivated Cochineal are very conſiderable, depending partly upon the climate and ſeaſon, partly upon the curation, and partly upon the ſpecies of plant.

The fruit of the Opuntia itſelf is of a red colour, and is ſaid, when eaten, to tinge the urine red: Thoſe ſorts, whoſe fruit is of the deepeſt red colour, are obſerved to produce the fineſt Cochineal. Sir Hans Sloane diſtinguiſhes the beſt ſpecies by the name of *Opuntia maxima, folio oblongo rotundo majore, ſpinulis obtuſis mollibus & innocentibus obſito, flore ſtriis rubris variegato*, the very large Opuntia, with an oblong roundiſh large leaf, beſet with ſoft blunt harmleſs ſpines, and a flower variegated with red ſtreaks. In the Memoirs of the French Academy for the year 1714, another ſpecies is preferred, namely, that called by Tournefort *Opuntia major validiſſimis ſpinis ſive aculeis munita*, the greater Opuntia armed with very ſtrong ſpines or prickles.

The beſt Cochineal is ſomewhat heavy, or at leaſt not very light, moderately compact, clean, dry, of a gloſſy ſurface, of a dark blackiſh red colour on the outſide, with white ſilver-like ſtreaks. Chewed, it tinges the ſpittle of a deep browniſh-red colour, and impreſſes a kind of faint not agreeable taſte. When thoroughly dry, it has no ſmell; when moiſt, a ſomewhat muſty one.

Analyſis.

A tincture drawn from powdered Cochineal by digeſtion with water, was very gelatinous: Out of four drams of Cochineal, one dram remained undiſſolved, and the extract obtained by evaporating the liquor weighed three drams. The ſame quantity, digeſted with rectified ſpirit, yielded two drams two ſcruples

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and a half of extract, or half a ſcruple leſs than with water; the reſiduum being half a ſcruple more. The ſpirit, drawn off by diſtillation, was found to have received no change; the diſtilled water had greateſt part of the muſty ſmell of the inſect.

Colour extracted and improved.

The tincture of Cochineal by itſelf is of a much weaker red colour than when certain ſaline additions are employed: Volatile alcalies in particular not only render the colour deeper and richer, but at the ſame time incline it rather to a purple than to a pure red; whilſt acids brighten, and if their quantity is large, deſtroy it. The ſpirituous tincture is of a finer red than the watery. I have made eighteen other experiments with different ſaline liquors and ſolutions, but as nothing very remarkable was obſerved, I ſhall not relate them here.

Analyſis by fire.

An ounce of Cochineal, diſtilled in an open fire very gradually and cautiouſly increaſed, gave over firſt two ſcruples and three grains of mere phlegm, then four ſcruples of an urinous ſpirit, and fifteen drops of an oily ſpirit, followed by twenty-two grains of volatile Salt, and five ſcruples two grains of empyreumatic Oil: The Caput mortuum weighed two drams two ſcruples, and yielded five grains of a fixt lixivial Salt.

Uſes.

Cochineal has been ſuppoſed to poſſeſs ſome medicinal virtues, but its principal uſe is as a colouring drug. It is with this inſect, that ſeveral of the red tinctures, waters and ſpirits of the ſhops are tinged; that ſcarlets and fiery reds are dyed upon ſilk and woollen; that Spaniſh wool uſed for a fucus, and ſome kinds of the red Turnſol rags, are ſtained; that Carmine, and ſome other fine red lakes, are prepared for the painter. The preparation of Carmine is deſcribed by Homberg in the Hiſtory of the French Academy publiſhed by du Hamel, pag. 345. but the *Chouan* and *Autour*, mentioned there, are now omitted.——This drug is extremely rich in colour: Boyle informs us that a ſingle grain, extracted by Spi-

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rit of Urine, gave a red tincture to 125000 times its quantity of water (u).

(u) *Hiſtory of Cochineal as a dying drug.*] Cochineal, infuſed or boiled in water, imparts a crimſon tincture, inclining to purple. After the more ſoluble parts have been got out by light infuſion or coction, the tinctures extracted from the remainder by ſucceſſive freſh parcels of water, have more and more of a purple hue. Woollen cloth, prepared by boiling with a little Alum and Tartar, acquires a crimſon dye on being boiled with a proper quantity of Cochineal in fine powder.

The beauty of crimſon, as Mr. Hellot obſerves, (from whoſe *Art de teinture* great part of the remainder of this article is extracted) is to incline as much as poſſible to the gridelin, or to be extremely deep. Fixed alcaline Salts give the deſirable deepneſs, but tarniſh the colour and diminiſh its luſtre. Volatile alcalies have the ſame good effect as the fixed, without their bad one; but the great volatility of theſe Salts occaſions them to be ſo plentifully diſſipated from the hot liquor, that a very large quantity would be neceſſary to effectually anſwer the purpoſe. Mr. Hellot, however, has diſcovered a method of applying them to good advantage: The cloth, dyed crimſon in the uſual manner, is dipt in a ſolution of a little Sal ammoniac; and as ſoon as the liquor grows moderately warm, a quantity of Pot aſh, equal to that of the Sal ammoniac, is thrown in: The volatile alcali of the Sal ammoniac is inſtantly extricated, and communicates to the cloth the brilliancy and deepneſs required.

A ſmall quantity of the vitriolic acid, dropt into a decoction of Cochineal, changes it to a purple: On adding more and more of the acid, the liquor becomes fleſh-coloured, and at laſt colourleſs. Spirit of Nitre, in like manner gradually dropt in, firſt inclines the colour to yellow, then turns it quite yellow, and at laſt almoſt deſtroys it; the acid diſſolving or attenuating the colouring particles, ſo as to render them indiſtinguiſhable by the eye.

Solution of Tin in Aqua regis heightens the colour into a ſcarlet, more or leſs fiery, that is blended with more or leſs of a yellow hue, in proportion to the quantity of the ſolution: The liquor, thus heightened, communicates its own ſcarlet colour to woollen cloth prepared by boiling with Tartar.

Other metallic ſolutions have not this effect. Zinc diſſolved in Spirit of Nitre, changes the red of Cochineal to a ſlaty violet: Solution of Biſmuth in Spirit of Nitre, diluted with an equal quantity of water, and dropt into a decoction of Cochineal, produced on prepared cloth dipt therein a very beautiful and lively turtle-grey: A ſolution of Copper in Spirit of Nitre, undiluted, gave a dirty crimſon: Solution of cupelled Silver, a ſomewhat tawny Cinnamon colour: Solution of Gold, a kind of marbled cheſnut, the cloth appearing as if compoſed of Wool of different colours: Solution of Mercury in Spirit of Nitre, nearly the ſame: Tincture of Biſmuth ore in Spirit of Nitre, a purple almoſt violet, as beautiful as if the Cochineal had been applied upon cloth previouſly dyed of a ſky blue. Vitriolated Tartar deſtroyed the red colour of the Cochineal, and produced a grey, though the ingredients of that Salt, ſeparately, have a different effect.

The dyers are ſaid to prepare their ſolution of Tin for ſcarlet, by pouring upon the metal a quantity of Aqua fortis diluted with water, with the addition ſometimes of a little Nitre, which is ſuppoſed to contribute ſomewhat to the uniformity of the colour. We have formerly ſeen, that Aqua fortis does not perfectly diſſolve this metal; and what it does diſſolve at firſt, it ſoon depoſites again, in form of a thick mucilage; the clear liquor retaining ſcarcely any thing of the me-

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tal. The proper menſtruum of Tin is Aqua regia, or a mixture of the nitrous acid either with the marine, or with neutral Salts containing it, as common Salt and Sal ammoniac. If eight ounces of Spirit of Nitre be diluted with an equal quantity of water, and half an ounce of Sal ammoniac and two drams of Nitre diſſolved in the mixture; the menſtruum ſo prepared will diſſolve, and keep diſſolved, about an ounce of Tin, provided the metal be previouſly reduced into grains or ſmall parts, and very leiſurely dropt into the liquor, grain by grain, waiting till one is diſſolved before another is put in. This ſolution depoſites no Mucilage: It becomes indeed opake and milky in the great heats of ſummer, but, in cold weather it reſumes its limpidneſs and tranſparency; and even in its milky ſtate, Mr. Hellot ſays, it is found to anſwer as well in every reſpect for dying ſcarlet as when it is tranſparent; whilſt the ſolutions made in the common manner, when once they have grown thick or opake, which they do in a day or two or leſs, cannot be employed at all for that uſe.

Woollen cloth requires, for being dyed ſcarlet, about one ſixteenth its weight of Cochineal; a part of which is uſed along with the Tartar in the preparatory liquor, from which the cloth receives a lively fleſh-colour; and the reſt for finiſhing the dye; a ſuitable quantity of the ſolution of Tin being added in both decoctions.

The copper veſſels, employed for the dying of other colours that require boiling, are leſs proper for ſcarlet; the acid liquor being apt to diſſolve a part of the Copper, which precipitates a proportionable quantity of the Tin, and deadens the colour and ſtains the cloth. Tin veſſels are commonly made uſe of, and are undoubtedly the moſt ſafe and certain: Their expenſiveneſs however, and the great precaution neceſſary to keep them from melting, have induced ſome of the French dyers to ſearch for means of making the proceſs ſucceed in Copper ones: By keeping the coppers extremely clean, and confining the cloth in a net ſo as not to touch the ſides, they are ſaid to have produced ſcarlets ſcarcely, if at all, inferior to thoſe dyed in Tin veſſels.

The ſcarlet proves darker or of a more fiery orange colour, according as the ſolution of Tin is uſed in ſmaller or larger quantity. Hence too great darkneſs is eaſily remedied by adding more of the ſolution; the cloth being previouſly taken out, and the additional acid mixed thoroughly with the liquor before it is put in again: Scarlet which has too much fire is darkened by paſſing it through warm water; and if the exceſs is greater than this can remedy, by diſſolving in the water a little Alum; but the injury which an over-proportion of the acid ſolution does to the cloth, is irremediable.

Some of the French dyers give fire to their ſcarlets, without any injurious quantity of the acid, by the addition of a yellow drug, Turmeric; but the luſtre which the Turmeric gives, like the dye of Turmeric by itſelf, ſoon periſhes. It is obſervable that the ſcarlet dye is only ſuperficial, the internal part of the cloth being white: When yellow drugs are added, they do not make the ſcarlet ſink, but ſink themſelves through the whole ſubſtance of the cloth, and thus are readily diſcovered upon cutting.

All urinous and alcaline ſubſtances ſtain ſcarlet to a crimſon, by deſtroying the effect of the acid: If ſcarlet cloth be boiled in alcaline Ley, it becomes firſt crimſon, then purpliſh, and on continuing the coction gives out the whole of its colour to the liquor; from which the colouring matter may be precipitated, by adding a ſolution of Alum, into a crimſon lake.——Hence in pure country air, ſcarlet retains its luſtre much longer than in large cities where alcaline and urinous vapours are more abundant. The dirt of roads, and ſundry ſubſtances of the acid kind,

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kind, leave no ſtain in ſcarlet, if the part be waſhed immediately with pure water and a white linen cloth. If the dirt is ſuffered to dry, a blackiſh violet ſpot will remain, which can be taken out only by mild vegetable acids, as Vinegar, Citron-juice; a warm dilute ſolution of white Tartar, or ſour bran-water: If theſe acids, however, be not applied with a good deal of addreſs, whilſt they take out the blackiſh ſtain, they leave a yellow one, by diſſolving the colouring particles of the Cochineal itſelf.

It is obſervable, that if a piece of ſcarlet be boiled in the liquor by which cloth is prepared for receiving this dye, it loſes immediately great part of its colour; which, if freſh pieces of white cloth are boiled along with it, will be imbibed by them, and equally diſtributed among them all. After the boiling has been continued about an hour, it will be difficult to diſtinguiſh that which had been ſcarlet from thoſe which were white.

After all the common proceſſes of dying with Cochineal, there is found at the bottom of the veſſels a conſiderable quantity of a deep brown-coloured ſediment. This is found, when ſolution of Tin has been uſed in the dye, to contain a calx of Tin, from which the Tin may be recovered, though ſomewhat difficultly, by fuſion with inflammable ſubſtances.

The reſt of the ſediment appears to conſiſt of the impurities of the Tartar, and the groſſer parts of the powdered Cochineal. The lighter animal matter being waſhed off with water, dried, ground on a marble with an equal quantity of cryſtals of Tartar into an impalpable powder, and then put into water with a little Alum; a piece of white cloth, boiled in this liquor for three quarters of an hour, acquired a very beautiful crimſon dye.

This experiment evinces, that by reducing Cochineal into a powder of moderate fineneſs as commonly practiſed, we do not gain all the advantage which this valuable commodity is capable of yielding. If the Cochineal, after the uſual pulverization, be mixed with one fourth its weight of pure dry cryſtals of Tartar, and the mixture levigated into a powder really impalpable, the ſaving, in the Cochineal, whether for the crimſon or the ſcarlet dye, will be, according to Mr. Hellot, about one part in four. Though no Tartar is uſually employed in the red or dying liquor, the quantity here directed does no injury; it appeared on trial, that the colour was rather the more ſolid for it. In the preparatory liquor, the quantity of Tartar may be diminiſhed proportionably to that contained in the powder.

The wild Cochineal or Sylveſter is greatly inferior to the fine ſort called ſimply Cochineal: Four parts of the former have no greater effect in dying than one of the latter. Nor does the Sylveſter anſwer, in general, ſo well as the other, in regard to the beauty of the colour, particularly for ſcarlet.

VI. KERMES.

KErmes grains, ſo called, are roundiſh bodies about the ſize and ſhape of a pea, containing under a firm reddiſh-brown ſkin, a great number of ſmall particles of a deeper red colour: found adhering in the ſouthern parts of Europe, to the branches and leaves of the ſcarlet Oak, *Ilex aculeata cocciglandifera C. B.* A ſmall inſect, leſs than a Millet ſeed, fixes itſelf upon the tree in the beginning of March, and is by degrees changed into this form: The body of the inſect becomes the huſk or ſhell, and the red particles are its eggs.

The Kermes grains are cured for exportation, by drying them on linen cloths; ſome ſtrong Vinegar being previouſly ſprinkled upon them to prevent the excluſion of eggs, or kill ſuch of the inſects as may be

already

already hatched. In drying, the eggs and young animalcules fall into a red powder, which in ſome places, particularly in Spain, is ſeparated from the huſks by a ſieve: The huſks are then formed into balls, and a proportionable quantity of the powder put into the middle of each.

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Freſh Kermes yields upon expreſſion a red juice, of a light pleaſant ſmell, and a bitteriſh, roughiſh, ſomewhat pungent taſte: This, made into a ſyrup with Sugar, is brought from the South of France for medicinal uſe, and held to be mildly reſtringent and corroborant.

The dry grains impart the ſame ſmell and taſte, and a deep red colour, both to watery and ſpirituous liquors: Both tinctures retain their colour on being inſpiſſated to the conſiſtence of extracts; nor do they loſe any thing conſiderable of their taſte, but the watery loſes all its ſmell.

Woollen cloth, prepared with Alum and Tartar, acquires, on being boiled with dry Kermes berries, a durable deep red colour, called *ſcarlet in grain* from the Kermes having been formerly ſuppoſed to be the grain or ſeed of the tree, and *Venice ſcarlet* from the greateſt quantities having been dyed there. This colour wants the luſtre and fire of the Cochineal ſcarlet now in vogue, but in return is far more permanent, not ſubject to be ſtained by dirt or acrid liquors, and when ſpotted with greaſe may be cleaned again without injury to the colour.

Mr. Hellot obſerves, that the figured cloths to be ſeen in the old tapiſtries of Bruſſels and the other manufactures of Flanders, which have ſcarce loſt any thing of their livelineſs in ſtanding for two hundred years, were all died with this ingredient: That nevertheleſs Kermes is at preſent entirely in diſuſe among the European dyers, though ſaid to be commonly employed in the Levant, and exported thither from Marſeilles in conſiderable quantities: That when the Kermes ſcarlet (now called an ox-blood colour) is wanted for tapiſtries, &c. our dyers endeavour to imitate it with Cochineal; that as the colour is difficultly hit with Cochineal alone, they generally add a portion of Brazil-wood; and that the dyes thus produced, though at firſt more vivid than they ought to be, often loſe their luſtre before a year is at an end, and turn white and grey in an extraordinary manner: That Kermes might be again introduced to very good advantage, as its colour is of the moſt durable kind, and as ſundry ſhades are obtainable from it with leſs trouble and expence than from other drugs.

The ſame author has given a great number of experiments upon Kermes, with different Salts and metallic ſolutions. The principal of theſe are as follows.

On adding to decoction of Kermes a ſmall quantity of ſolution of Tin, the dark colour of the liquor is immediately brightened, and prepared woollen dyed therein inclines more to the orange than with the Kermes alone. With this improvement of the colour, it receives the imperfections, though not all the beauty of the Cochineal ſcarlet; all alcaleſcent ſubſtances ſtaining the cloth, that is deſtroying the effect of the acid ſolution.

Kermes with Creme of Tartar and as much of the ſolution of Tin as is employed for the Cochineal ſcarlet, (without any Alum,) dyed unprepared cloth of an extremely vivid Cinnamon colour. On dipping the cloth in a ſolution of Alum, a part of the red reappeared, but was not beautiful.

With Creme of Tartar, ſolution of Tin, and Alum in larger quantity than the Tartar, this drug gives purpliſh colours, which vary according to the proportions of the ingredients.

If vitriolated Tartar be ſubſtituted to the Alum and Tartar; and if after the Kermes has been boiled in a ſolution of a ſmall quantity of this

Salt, the ſtuff be boiled in this mixture for about an hour, the dye proves a beautiful kind of grey, in which the red is little perceived.

Glaubers Salt employed along with Kermes entirely deſtroys its redneſs, and gives an earthy grey colour. This dye is very periſhable, on account of the particular nature of the ſame ſubſtance by means of which the tinging particles are applied; for Glauber's Salt diſſolves eaſily in cold water, and falls into a powder in the ſun's heat. This obtains equally in all dyes; thoſe drugs which afford moſt durable colours with Tartar and vitriolated Tartar, give very periſhable ones with the more diſſoluble and calcinable Salts.

Green and blue Vitriol, ſubſtituted ſeparately to Alum, but taken in conjunction with Cream of Tartar, deſtroy likewiſe, or conceal the red colour of Kermes, which in theſe two experiments has the ſame effect with Galls, for it precipitates the Iron of the green Vitriol which tinges the cloth of a bright grey, and the Copper of the blue which gives a kind of olive dye. It likewiſe gave an olive dye with ſolution of Copper made in Aqua fortis; a certain mark, that it poſſeſſes, like Galls, an aſtringent precipitating quality. It is probably the aſtringency of Kermes that renders its dye ſo durable; for all the barks, woods, roots and other ſubſtances that are aſtringent, yield permanent colours.

White Vitriol, employed with cryſtals of Tartar, changes the red colour of Kermes into a violet. A tincture of Biſmuth ore in Spirit of Nitre, and a ſolution of Biſmuth itſelf made leiſurely in four times its weight of Spirit of Nitre diluted with an equal quantity of water, gave alſo a violet dye upon white cloth.

VII. COCCUS POLONICUS.

Coccus Polonicus is the egg of an inſect, about the ſize of a Coriander ſeed, of a purple-brown colour on the outſide and full of a blood-red juice; found adhering to the upper part of the roots of a ſpecies of Knot-graſs called *Polygonum cocciferum*, Polonian Knawel. It is met with in great abundance in waſte ſandy grounds in different parts of Poland, particularly in the Ukrain.

According to Bernhardus a Bernitz (in the *Ephemerides naturæ curioſorum. dec. 1. an. 3.*) the peaſants take up the plant about midſummer, by means of a ſmall concave ſpade or dibble, and having picked off the berries as they are called, replace it in the ground, with ſurpriſing celerity and addreſs. The Coccus, cleaned from the earth by ſifting, is dried in a warm room or by the ſun's heat; ſome Vinegar or very cold water being ſprinkled on, to prevent the excluſion of the inſects. Sometimes the red matter is ſeparated from the ſkins and formed into balls by gentle preſſure, ſo as not to ſhed or waſte the colouring juice.

The ſame author relates, that the Turks and Armenians, who purchaſe the Coccus from the Jews in Germany, employ it for ſtaining wool, hair, leather, and the manes and tails of their horſes, red: That the juice mixed and extracted with Citron or Pomegranate-juice, or with Wine, is in daily uſe among the Turkiſh ladies, for ſtaining the ends of their fingers and toes: That formerly the Dutch dyers mixed their Cochineal with one half of Coccus Polonicus both for ſcarlets and for crimſons: That a tincture of the Coccus extracted with Citron juice, or a certain Lixivium, with Alum and a little Gum arabic, was uſed by the painters, particularly in Ruſſia: That with whiting it yields a crimſon lake equal to that prepared from Cochineal or ſcarlet cloth: That he ſaw an excellent Carmine made from it by a particular perſon at Paris, which was ſold for three guineas (*tribus aureis*) a dram: And that the red Spaniſh paper and wool, ſo much in uſe at the toilettes of the

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French and Spaniſh ladies, receive their colour from the juice of this drug.

The trade in this commodity has nevertheleſs been for a long time very inconſiderable: Among us, the Coccus is at preſent ſcarcely otherwiſe known than by name. Mr. Hellot informs us, that having procured ſome from Dantzick, for trial as a dying drug, it came dearer than Cochineal, as it did not afford one fifth ſo much colour as that American inſect does; and that he never could by any means obtain from it a ſcarlet dye; nor any other than *lilas*, fleſh colours and crimſons, more or leſs lively. Mr. Marggraf obſerves, in the Berlin Memoirs, that this inſect contains, like Ants, an expreſſible Oil; that this principle is the cauſe of the failure of thoſe who have employed it in dying; and that means may be found of preventing the ill effects of the oily matter. For my own part, I have had no experience of it.

VIII. PURPLE FISH.

THE precious Tyrian purple of the ancients was procured from a ſhell-fiſh of the *Buccinum* or Whilk kind: A ſmall vein found in the body of the animal, though colourleſs itſelf, communicated the admired dye.

Towards the end of the laſt century, the ſame ſort of fiſh was diſcovered in plenty on ſome of the ſhores of Ireland, on thoſe of Somerſetſhire, and the oppoſite ones of South Wales; and ſome perſons made conſiderable profit by marking linen with its juice, of a fine durable crimſon colour.

The ſhell, which is conſiderably hard, is broke by a ſmart blow, with care not to cruſh the body of the fiſh within. After picking off the broken pieces, there appears a white vein or reſervoir, lying tranſverſely in a little furrow near the head. This being carefully taken out, and characters drawn with it, or its viſcid juice ſqueezed, upon linen or ſilk; the part acquires immediately on being expoſed to the ſun, a pale yellowiſh green, which quickly deepens into an emerald green, then changes to a blue, and at laſt to a fine purpliſh red. If the cloth be now waſhed with ſcalding water and Sope, and laid again in the ſun, the colour changes to a beautiful crimſon, which ſuffers no further alteration from ſun or air, or Sope, or Alum, or alcaline Leys, or any of the ſubſtances uſed for eſſaying the permanency of colours.

The juice of the Purple Fiſh receives no colour itſelf, and communicates none to ſilk or linen, without expoſure to the ſun. It ſeems to be the light, and not the heat of the ſun, that calls forth the tincture; for when the cloth is covered with thin opake bodies, which tranſmit heat without light, no colour is produced, while tranſparent ones give no impediment to its production. The juice itſelf, in cloſe glaſs veſſels, becomes preſently purple in the ſun. The light of culinary fire, concentrated by convex glaſſes and concave mirrors, has no effect. The ſucceſſion of colours is beſt obſerved when the ſun is low and his action weak; at noon in ſummer they are ſo quick as not to be eaſily diſtinguiſhed. See the Philoſophical Tranſactions, Nº 178, and the Memoirs of the French Academy for the year 1736, and 1711.

Mr. Reaumur informs us, in the Memoirs for the year laſt mentioned, that on ſome of the French coaſts he found great numbers of ſmall elliptical ſpheroidal bodies adhering to the rocks by a ſhort ſtem like fruits, and that the purple fiſhes were commonly accumulated plentifully about theſe. On examining theſe bodies, he found them to be veſicles filled with a liquid of the ſame quality with the juice of the fiſh, but leſs viſcid, and of conſequence more readily ſpreading upon the linen. He ſuſpects them to be the eggs of ſome ſea fiſh, perhaps of the Purple

SECT. IV.

HORNY PARTS of ANIMALS.

HORNS.

BY horny parts we underſtand thoſe, which are dry and hard, and in ſome degree flexible, very conſiderably ſo when heated, and ſo coheſive as not to be at all pulverable in a mortar; whether produced upon the forehead, or on the feet of animals. The general name of the claſs might be taken indeed with greater propriety from the productions of the feet; for the hoofs and claws and nails of all animals are of this kind, but ſome horns are not. The horns of the Rhinoceros and the Ox are of the truly horny kind, but thoſe of Hart are of the bony.

I. RHINOCEROS'S HORN.

THE RHINOCEROS is ſo called from ῥιν a noſe, and κέρας a horn; the horn or horns being placed, not where thoſe of other animals are, but immediately above the noſe, betwixt the eyes. The Rhinoceros is a very large, fierce quadruped of prey; an inhabitant of woods and deſarts in different parts of Aſia and Africa. He has very little hair, but the ſkin is remarkably tough and ſtrong, above half an inch thick, and full of wrinkles, ſo as to look, when he moves, like ſcales. He is ſwift of foot, though the legs are ſhort; and of an extraordinary quick ſcent: The ſight is weak, and the eyes deep; ſo that he cannot ſee ſidewiſe, nor turn quick. The figures of this animal, given by natural hiſtorians differ from one another: The ſkin preſerved in the Muſæum of the Royal Society of London, comes the neareſt to thoſe of Bontius and Piſo.

This animal has been generally ſuppoſed to have only one horn, but appears to have often two, a large and a ſmall one; of which there are ſpecimens in

Fiſh itſelf, though he never could obſerve any thing like them on diſſecting that fiſh, nor any animal produced from the veſicles. He ſays they are in perfection only in autumn; and that when any are met with in ſummer, they have either loſt their colouring juice, or the juice has loſt its power of becoming purple in the ſun.

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Rhinoceros's Horn.

many collections in Europe, particularly in that of his Danish majeſty. The horn is at firſt white; by age it grows grey, and at length blackiſh on the outſide, its internal whiteneſs continuing: Its length is from a quarter of an ell to an ell, according to the age of the animal: It is always ſomewhat crooked, remarkably thick at the bottom, and not equably taper or of a regular pyramidal figure, but drawn in ſlender a good way below the tip: It is ſolid throughout, except a little hollowneſs at the baſis, where it is alſo externally rough, chapt, full of ſmall holes, and beſet with ſtiff hairs, of which in the horns brought to us, only the roots generally remain: The upper part is ſmooth. Its texture is very compact; and in thin pieces it has ſome degree of tranſparency. It is uſed for ſundry mechanic purpoſes, as for making ſword-hilts, knife-handles, cane-heads, ſnuff-boxes, and other toys. It was formerly of great eſteem for drinking veſſels, from an idle notion of its reſiſting poiſon.

Half an ounce of Rhinoceros's horn, finely raſped, gave with rectified Spirit of Wine only four grains of extract, which had a rancid taſte, without any ſmell: The remaining horn looked reddiſh. The ſame quantity, boiled ſtrongly with water, yielded two ſcruples of gelatinous extract, of a brown colour, and ſomewhat ſaline taſte: The reſiduum was grey. The mineral acid ſpirits, and cauſtic alcaline Lixivia, almoſt totally diſſolve it: The ſolutions made in the nitrous and vitriolic acids are yellow; in the marine, colourleſs. Weaker ſaline menſtrua, as Oil of Tartar per deliquium, Spirit of Sal ammoniac, and the vegetable acids, have no effect on it: We may judge from hence, that this horn can have no great claim to any medicinal virtue, as it is not diſſoluble in the fluids of animal bodies.

Two ounces of the raſped Horns, diſtilled in a retort with an open fire, yielded half an ounce and a ſcruple of urinous liquor, two drams of fetid Oil, and three drams and a ſcruple of volatile alcaline Salt: The Caput mortuum, which weighed ſix drams, af-

forded

RHINOCEROS'S HORN.

forded a ſmall portion of fixed lixivial Salt. The phlegm which aroſe at firſt, amounting to about two drams and a ſcruple, was conſiderably fetid, and had ſomewhat of a volatile ſmell.

There are ſome other animals which have received the name of Rhinoceros, from their being furniſhed with a horn ſituated nearly in the ſame manner. One is the *ſcarabæus cornutus* or horned chafer, found about tan pits and where leather is buried in the ground. Another is the Rhinoceros bird, or horned Indian Crow: Its beak, and the upper part of the horn, is red like minium, the middle yellow, and the margin ſtreaked with black: An entire head is preſerved in the Muſæum of the Royal Society. Willoughby and others mention alſo an Indian horned fiſh.

II. OX-HORN.

THE horns of OXEN and COWS are leſs compact than thoſe of the Rhinoceros, but more tranſparent. They are uſed for tobacco and ſnuff-boxes, for powder-horns, the horns of lanthorns, imitations of tortoiſeſhell, *&c.* as alſo for hardening Iron by cementation, *&c.*

Half an ounce of theſe horns, digeſted with rectified Spirit of Wine, gave five grains of extract, or one grain more than I had obtained from an equal quantity of the Rhinoceros's horn. Boiled in water, they yielded leſs extract than the horn of that animal; only five and twenty grains being obtained from half an ounce, whilſt the ſame quantity of the other gave forty grains. The watery extract was of a yellowiſh-brown colour and ſaline taſte, and the reſiduum grey: The ſpirituous extract was the ſame with that of the Rhinoceros's horn, but the remainder had acquired no redneſs or change of colour.

Spirit of Nitre diſſolves theſe horns totally. Spirit of Salt diſſolves them only in part; the ſolution is of a reddiſh-yellow colour. Spirit of Vitriol alſo only partially diſſolves and corrodes them, acquiring a ſlight yellow tinge. Spirit of Sal ammoniac and Oil of Tartar extract exceeding little: The liquors, however, become yellowiſh, and the horn brown. Cau-

Ox-horn.

Its alcaline Lixivia totally diſſolve the horn into a yellow liquor.

Sixteen ounces of Cow's-horn, diſtilled in an open fire, gave over in all nine ounces and a half of mixed matter: Of Volatile Salt I had two ounces three drams; of urinous ſpirit five ounces and a half; and of empyreumatic Oil one ounce five drams; the Caput mortuum weighed five ounces and a half; and in calcination to whiteneſs loſt an ounce: From the white calx I extracted, by elixation with water, ſix grains of a fixed ſaline matter.

In another diſtillation of Cow's horn, I obtained, from two ounces of the horn, half an ounce and half a dram of urinous liquor, a dram and a half of fetid Oil, and three drams and a half of volatile Salt (*x*): The Caput mortuum weighed ſix drams and a half, which probably would not have yielded a ſingle grain of fixed Salt, as in the foregoing experiment I had obtained but ſix grains of that Salt from ſixteen ounces of the horns.

III. Tortoise-shell.

THE beautiful ſhell of the TORTOISE belongs alſo to this claſs. The Tortoiſe is an oviparous four-footed animal, whoſe body is incloſed in two ſhells joined together along the ſides, into which it can likewiſe occaſionally draw in both the feet and the head: The upper ſhell is convex, the lower flat. There are many different kinds of Tortoiſes in America and the Eaſt Indies, ſome living almoſt wholly on the land, others almoſt wholly in water, and others equally in both; ſome of an oval and others of an angular figure; of various colours on the upper ſhell, as yellow, black, brown, white, purple, greeniſh, with different clouds and variegations; ſome ſmall, weighing a few pounds, and others of enormous ſizes.

(*x*) *Volatile Salt.*] The proportion of volatile Salt in theſe two experiments is conſiderably different, being in one *two ounces three drams*, and in the other *three ounces four drams* from ſixteen ounces of the horn. Whether this has happened through any miſtake, or from different pieces of horn affording quantities of Salt really ſo different, or from more of the Salt having been diſſolved by the ſpirit in one experiment than in the other, I cannot determine. Perhaps, as the two analyſes appear to have been made at diſtant times, and with ſomewhat different views; in the former the *purified Salt*, and in the latter the *rough Salt* may be meant.

TORTOISE-SHELL.

The upper ſhell of the Tortoiſe is compoſed of two diſſimilar ſubſtances: That which immediately inveſts the back of the animal is of the bony kind, and almoſt as hard as ſtone: The outer lamina is horny, flexible, here and there tranſparent. It is only this laſt that is called Tortoiſe-ſhell, and in which the beautiful colours and variegations reſide. The horny ſhell conſiſts of ſeveral pieces, whoſe ſeams and junctures with one another, and with the bony part underneath, are ſufficiently diſtinguiſhable. The workmen ſplit them aſunder by certain inſtruments, and employ the elegant horn for a variety of toys and utenſils, combs, ſword-hilts, clock-caſes, boxes, coverings for muſical inſtruments, perſpective-glaſſes, &c. &c. I have often been ſurprized at their dexterity in working and poliſhing this ſhell, but particularly at the neat manner in which they unite two pieces together, the union being ſo curiouſly performed, that it is ſcarce poſſible to diſtinguiſh the juncture. They have likewiſe methods of embelliſhing it with ſundry beautiful colours, beſides thoſe which it receives from nature (*y*).

Half an ounce of Tortoiſe-ſhell, digeſted with Spirit of Wine, yielded four grains of extract, which ſmelt like the newly diſtilled water of Cow-dung (*Aqua omnium florum*) and taſted ſomewhat ſaline. Another half ounce, boiled in water, gave fifteen grains of extract, of a brown colour and ſaline taſte. The ſhell remaining after the action of both menſtrua, was in appearance unchanged.

(*y*) *Working and joining of Tortoiſe-ſhell.*] Tortoiſe-ſhell and horn become ſoft in a moderate heat, as that of boiling water, ſo as to be preſſed, in a mould, into any form, the ſhell or horn being previouſly cut into plates of a proper ſize.

Plumier informs us, in his *Art de tourner*, that two plates are likewiſe united into one by heating and preſſing them; the edges being thoroughly cleaned, and made to fit cloſe to one another. The Tortoiſe-ſhell is conveniently heated for this purpoſe by applying a hot iron above and beneath the juncture, with the interpoſition of a wet cloth to prevent the ſhell from being ſcorched by the irons: Theſe irons ſhould be pretty thick, that they may not loſe their heat before the union is effected.

Both Tortoiſe-ſhell and horns may be ſtained of a variety of colours, by means of the colouring drugs commonly uſed in dying, and by certain metallic ſolutions. See the article *Bones* in the following ſection.

Tortoiſe-ſhell.

Spirit of Vitriol diſſolves greateſt part of it into a reddiſh-brown liquor: Spirit of Nitre and Spirit of Salt diſſolve the whole; both theſe ſolutions are ſomewhat yellowiſh. Spirit of Sal ammoniac corrodes it a little, but receives no colour. Fixt alcaline Lixivia likewiſe corrode a little of the ſhell, and acquire a yellowiſh tinge: Cauſtic alcalies corrode more of it, and become yellower.

Two ounces of Tortoiſe-ſhell, diſtilled in an open fire, yielded a dram and a half of phlegm, of an urinous ſmell; a dram and a half of a pretty fetid urinous ſpirit; half an ounce of empyreumatic Oil, which ſmelt likewiſe very volatile, but leſs fetid than the ſpirit; and three drams and a half of volatile Salt extremely fetid. The Caput mortuum weighed five drams and a half.

IV.
Elks-hoof.

AS the hoof of the Elk has been celebrated for ſome extraordinary qualities, it was thought proper to examine it chemically, and compare it with that of the ox.

The Elk is a wild quadruped, of the Stag kind, but ſomewhat larger, extremely fearful of men, an inhabitant of woods in the cold countries, as Poland, Ruſſia, Lithuania, Courland, Sweden, Norway, Ruſſia, *&c.* It is a great rarity if any of them ſtrays into Sileſia, Pomerania, Hungary or our neighbourhood [Berlin.]. Moſt of us however have ſeen the animal, as his Majeſty has often had young ones brought from Pruſſia. The male ſheds his horns annually like the common Stag, but the female has no horns. The fleſh is ſaid to be equal to veniſon.

The ſkin of this animal is one of the thickeſt, ſtrongeſt, and fineſt kind of leather in the world. The bones are ſaid to be not inferior to ivory, and to have one advantage above it, that they are not ſo apt to turn yellow. The hoof is made into boxes, bracelets, rings, and other toys.

The hoof of the Elk is commonly ſomewhat longer and larger than that of the Stag, of a black colour on the outſide and whitiſh within. The outer part is very compact, firm and horny; the inner white part

is

ELKS-HOOF. is tranſparent; and within this is another whitiſh ſubſtance. On each foot there are two large cloven hoofs, and above theſe two ſmaller ones.

It is ſaid that the Elk is ſubject to epileptic fits; and that he effectually cures them by ſcratching behind his right ear with his left hinder hoof, or behind his left ear with the hinder hoof of the right ſide; for the hoof of the ſame ſide, or the hoof of the fore foot will not do: From hence Elk's-hoof has been celebrated as a ſpecific in epilepſies, being taken internally, or worn as an amulet. If one could be ſerious on ſuch a ridiculous occaſion, we might aſk, how it comes that the Elk ſhould ever be troubled with an epilepſy, when he carries the Amulet conſtantly about him: Whether a man will be affected in the ſame manner by ſwallowing a piece of the hoof in powder, as the animal was by ſcratching himſelf with it: Whether it is anywiſe poſſible for the Elk to get his hinder hoof up to his ears; and if it was, whether the ſcratching might not be more rationally attributed to another cauſe. According to ſome accounts, a kind of ſtinging fly attacks and lodges in his head, and occaſion ſuch uneaſineſs, as might very well warrant his ſcratching himſelf, without any thing epileptic in the caſe.

Half an ounce of raſped Elk's-hoof, digeſted with rectified Spirit of Wine, gave ſix grains of extract, which had no remarkable ſmell or taſte: The reſiduum looked reddiſh. Water extracted from the ſame quantity two ſcruples: The inſpiſſated extract had a ſaline taſte, but no ſmell; The reſiduum looked greeniſh.

Spirit of Vitriol partly diſſolved and partly corroded it: Of the corroded matter, part ſwum on the ſurface, and part ſunk to the bottom: The ſolution was reddiſh-brown. Spirit of Nitre totally diſſolved it into a Citron yellow liquor. Spirit of Salt partly diſſolved and partly corroded it, and acquired a richer yellow tincture. Spirit of Sal ammoniac had no effect: Solution of fixt Alcali extracted a ſlight yellow-

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Elks-hoof.

iſh tinge: Solution of cauſtic Alcali totally diſſolved it, and became likewiſe yellowiſh.

On diſtilling two ounces of Elk's hoof in an open fire, I obtained firſt two drams of a phlegmatic liquor, which ſmelt like Sope; afterwards a dram and a half of a ſtinking ſpirit, three drams of empyreumatic Oil, and half an ounce of volatile Salt. The Caput mortuum weighed five drams and a half.

V.
Ox-hoof.

THE hoofs of OXEN and COWS differ very little from that of the Elk, and have commonly been ſubſtituted to it in the ſhops. It is ſaid that Ox's-hoof ſtinks in raſping, whilſt that of the Elk emits an agreeable ſmell. On trial, the ſmell of both was found to be diſagreeable: That of the Cow's-hoof was moſt ſo, not however from any peculiar quality of the hoof itſelf, but from the dung and urine in which this kind of cattle ſo often ſtands. When the hoofs of Cows or Oxen are thoroughly cleaned, their ſmell does not prove remarkably different from that of the Elk's.

From half an ounce of raſped Ox's-hoof I obtained ſix grains of ſpirituous; and from the ſame quantity, half a dram of watery extract. The reſidua were of the ſame colour as thoſe of the Elk's hoof; but there was this difference in the ſpirituous extract, that it ſmelt and taſted a little like Cow-dung. Spirit of Vitriol partly diſſolved and partly corroded Ox's-hoof, in the ſame manner as the Elks, but the ſolution was more of a browniſh colour. Spirit of Nitre diſſolved this equally with the other: The ſolution had leſs of the Citron hue. Spirit of Salt, which partially diſſolved the Elk's, almoſt totally diſſolved the Ox's-hoof into an orange-yellow liquor. Spirit of Sal ammoniac, and ſolution of fixed alcaline Salt, extracted a ſlight yellowiſh tinge: Solution of cauſtic Alcali almoſt totally diſſolved it into a yellowiſh liquor.

Two ounces of raſped Ox hoof, diſtilled in an open fire, gave over four drams and a half of urinous ſpirit, which ſmelt ſomewhat like Aſa fetida; one dram and a half of empyreumatic Oil; and half an ounce of volatile Salt: The Caput mortuum weighed ſix drams.

Ox-hoof. drams. The Oil and Salt had the uſual empyreumatic ſmell.

In another diſtillation of Ox-hoof, I obtained from ſixteen ounces of the hoof, ſeven ounces ſix drams of urinous ſpirit, one ounce two drams of volatile Salt, and two ounces of empyreumatic Oil. The Caput mortuum weighed three ounces, and was reduced by calcination to two ounces two drams, which yielded on elixation with water twelve grains of a fixed ſaline matter.

VI. Whale-bone. THE flexible horny ſubſtance, called WHALE-BONE, arms the gums of the common Whale, in the room of teeth. In the mouth of one Whale there are five hundred pieces of this bone, ſome of which are five or ſix ells in length.

Two ounces of Whale-bone, boiled with water, yielded four ſcruples of extract; and afterwards with rectified ſpirit, half a dram: On inverting the order of applying the two menſtrua, I got from the ſame quantity, one dram and four grains of ſpirituous, and afterwards a dram of watery extract. The indiſſoluble part weighed in the firſt caſe one ounce ſix drams eight grains, in the latter one ounce ſix drams thirty grains.

On diſtilling ſixteen ounces of Whale-bone in an open fire, there aroſe five ounces of urinous ſpirit, two ounces of empyreumatic Oil, and a volatile Salt, which when rectified weighed ten drams. The Caput mortuum weighed five ounces, and on being burnt in open veſſels to whiteneſs loſt juſt one half: From the aſhes were extracted, by means of water, fifteen grains of ſaline matter.

SECT. V.

BONY PARTS of ANIMALS.

Bones. BONY ſubſtances are the hardeſt and firmeſt of all the parts of animals; more or leſs brittle; either not at all, or in a very ſmall degree flexible, and not capable of being ſoftened by heat like

Bones.

like horn, ſo as to receive figures or impreſſions. Under this head are comprehended not only bones ſtrictly ſo called, but ſome kinds of horns and other animal productions: The horns of the Hart and the Elk are, chemically conſidered, of the bony kind, whilſt the bones of many ſorts of fiſhes, particularly of ſmall ones, are horny or cartilaginous.

Clean ſound bones are white, and of a cloſe compact texture: Such as are diſeaſed, look yellow, browniſh or blackiſh, and porous or corroded: I have ſeen, in England, the ſkeleton of a perſon who died in the laſt ſtage of the venereal diſeaſe, whoſe bones were all carious and corroded, not a ſingle one in the whole body being ſound. It is matter of common obſervation, that Sugar, too hot and too cold liquors, ſmoking tobacco, *&c.* make the teeth yellow, black, and carious. Two proceſſes are deſcribed in the *Acta Hoffmienſia* for whitening bones: Profeſſor Rau had a method of giving them a great degree of whiteneſs. By bare expoſure to the air, ſun, and rain, for a length of time, they become notably white; but the whiteſt bones, kept in rooms tainted with ſmoke or fuliginous vapours, grow in a little time yellowiſh, browniſh, and unſightly. It is cuſtomary for the purification of bones, to boil them in alcaline liquors; which by diſſolving and extracting the ſuperfluous fat, improve their whiteneſs.

Whitened.

Hardened and ſoftened.

Boerhaave obſerves, that alcaline Salts render bones harder and firmer; and that acids make them ſofter and more flexible (z). Theſe effects ſucceed in

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(z) *Bones ſoftened by acids.*] In the hiſtory of the French Academy for the years 1742 and 1743, there is an account that Mr. Geoffroy produced before the Academy a ſmall ivory ſpoon, which by lying long in Muſtard was become flexible and tranſparent like horn: That Mr. Fouchy ſaw an ivory ſpoon, which by lying for a conſiderable time in Milk was become ſupple like Leather; and that Mr. Hunauld produced bones which had been ſoftened by ſteeping in Vinegar, afterwards hardened to their natural ſtate by ſteeping in water, and ſoftened a ſecond time by Vinegar.

I have obſerved that the nitrous and marine acids diluted, and the acetous acid, make bones flexible and tough like leather; but that the diluted vitriolic acid, though it renders them notably ſoft, makes them at the ſame time brittle. It ſeems as if great part of the earthy matter, BONES. in certain circumſtances, but not univerſally; for bones may be hardened and ſoftened bth by acids and by alcalies, according to the quantity of the ſaline matter employed, and the manner in which it is applied. I have made bones harder and more compact, by treating them with the ſtrongeſt of the mineral acids; though, when the acid is in ſufficient proportion, it deſtroys or diſſolves them. In Papin's digeſtor (a ſtrong cloſe veſſel, in which the ſteam of boiling liquors is confined, and the fluid by this means made to undergo a greater degree of heat than it could otherwiſe ſuſtain,) the hardeſt bones are reduced, in a ſhort time, by the action of ſimple water, into a ſoft pap or gelly; and alcaline liquors produce this effect ſtill ſooner.

In open veſſels, entire bones are difficultly, if at all, to be boiled ſoft by water; but ſuch as are raſped, or otherwiſe reduced into ſmall parts, give out to that menſtruum greateſt ſhare of their Oily, gelatinous, and ſaline matter. What remains is almoſt a mere

Calcined. alcaline earth: Urged with an open fire, it diſcovers but a ſlight fetid ſmell; and in mixture with Nitre, it occaſions very little deflagration. Raſped bones in ſubſtance, mixed with Nitre and *injected into a red-hot* crucible, deflagrate ſtrongly, and are very quickly calcined and reduced into a pure white earth.

Large entire bones are difficulty calcined to whiteneſs throughout, a part in the middle remaining black and coaly, unleſs the fire is very ſtrong and long continued. It is obſervable, that ſimple calcination, does not reduce bones, as it does vegetable ſubſtances, to aſhes; the bone ſtill retains its orignal figure, but becomes brittle and crumbly. Boerhave reports, that

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which is the baſis of the bone and on which its hardneſs depends, was diſſolved and extracted by the three firſt, whilſt the latter, incapable of diſſolving this kind of earth into a liquid form, only corrodes it into a kind of ſelenetic concrete (See page 320.) which remains intermixed in minute particles among the gelatinous matter.

I have not found that the ſoftened bones, whatever acid they were ſoftened by, recovered their hardneſs by ſteeping in water. Slips of ſoftened Ivory, after lying above a month in Water, continued nearly as ſoft as when they were taken out of the acid liquor.

bones

Bones.

Bones thus rendered brittle recover their priſtine hardneſs on being ſoaked in water; but on trial this did not happen: And indeed I could not expect that it ſhould happen, as the bone loſes in calcination its conglutinating, oily, and ſaline parts, which ſimple water cannot poſſible reſtore to it.

Their uſes.

Bones are a very uſeful article, not only for making different kinds of toys, but likewiſe in ſeveral of the chemical arts; as for making caſt iron malleable; for abſorbing the Sulphur of ſulphureous ores; for forming teſts and cupels, or veſſels for refining Gold and Silver with Lead, burnt bones, compoſing a maſs of a porous texture, which abſorbs the vitrified Lead, and other metals, whilſt the unvitreſcible Gold and Silver remain entire behind; for the preparation of milky glaſſes and porcelaines; for the rectification of volatile Salts, and empyreumatic Oils; and for making Glue. The bones of different animals are not equally fit for different uſes: Even, the Glue or gelatinous part of the bones of one animal is notably different, both in quantity and coheſiveneſs, from that of another as we ſhall ſee hereafter.

Artificial Turcois.

We often find in the earth petrified bones, greateſt part of their gelatinous matter being extracted by the moiſture, and a ſtony one introduced in its room. In ſome parts of France, petrified bones are met with, which have an impregnation of Copper: Hence on being calcined a little in an open fire, a volatile Salt is produced from the remains of their gelatinous principle, and the bone is tinged throughout of a fine greeniſh-blue colour, Copper always ſtriking a blue with volatile alcalies. The French Turquois ſtones are no other than theſe bones prepared by calcination: They are very durable, and bear to be worked and poliſhed, nearly in the ſame manner as Glaſs; without the imperfection, inſeparable from glaſſy bodies, of being brittle (a).

(a) *French Turcoiſes.*] Mr. de Reaumur has given a paper on this ſubject in the Memoirs of the French academy for the year 1715. He informs us that the mines which afford Turcoiſes are, chiefly in the lower Languedoc, near the village Simore: That the ſtones, as taken out of

BONES.

We ſhall now proceed to examine, more particularly, the bony ſubſtances of different animals. [illegible] here it may be proper to obſerve, that as a thorough knowledge of the chemical ſtucture and principles of the different ſubſtances ranked together in one ge-

the mine, reſemble different bones, teeth, &c. of various ſizes; and are in colour whitiſh, grey, or yellowiſh, like the ſtones commonly uſed in building: That they receive their blue colour on being ſlowly heated to ignition; and that if the fire is continued after they have acquired the colour, they loſe it irrecoverably: That the colour, when in perfection, is an opake blue, inclining to green, but without any ſenſible admixture of that colour; and that he has ſeen ſome of them equal in hardneſs as well as colour to thoſe of Perſia: That the beſt are ſcarcely ſo hard as Cryſtal, and that they have a peculiar imperfection of changing, on being long kept to various ſhades of green, whilſt the colours of other precious ſtones are unalterable: That the methods directed by authors for reſtoring their beauty do not perfectly ſucceed; a Perſian Turcois, which had become green, being ſteeped in Aqua fortis for twenty-four hours, the green colour diſappeared indeed, but the blue which the ſtone acquired was ſo faint than it was not of more value than when it was green: And that the French Turcois is totally diſſolved by Aqua fortis, and gives out its colour to diſtilled Vinegar . . . . This diſſolubility of the French Turcoiſes in acids which have no action on the oriental, ſhews that the baſis of the one is a different kind of earth from that of the other, and affords a ready method of diſtinguiſhing the two.

Colouring and hardening of bones.] Bones and horns may be ſtained of a variety of colours, by ſteeping or boiling them in decoctions of the vegetable and animal ſubſtances by which woollen and ſilk are dyed. See the reſpective colouring drugs.

They are ſtained alſo, without heat, by metallic ſolutions; and by means of theſe may be ſpotted or variegated at pleaſure. Thus ſolution of Silver in Aqua fortis gives a brown or a black according to its quantity; ſolution of Gold in Aqua regia or in Spirit of Salt, a fine purple; ſolution of Copper in the acetous acid, a fine green; and ſolutions of the ſame metal in volatile alcalies, a blue, which at firſt is deep and beautiful, but changes, upon expoſure to the air, into a green or a bluiſh-green. If the bone or horn is but touched with the two firſt ſolutions, and expoſed to the air, it does not fail to acquire the colour in a few hours: In the two latter, it requires to be ſteeped for a day or longer in order to its imbibing the colour. In theſe and other caſes where immerſion for ſome time is neceſſary, the bone may be variegated by covering ſuch parts as are intended to remain white, with Wax or any other matter that the liquor will not diſſolve or penetrate.

There is a ſingular induration of bones produced by fire; the effects of which agent are here remarkably different, according to its degree and the circumſtances of its application. Bones expoſed to a moderate fire, either in open veſſels or in contact with the burning fuel, become opake, white, and friable throughout; and an increaſe of the fire, after they have once ſuffered this change, renders them only more and more friable. But if they are urged at firſt with a ſtrong fire, ſuch as that in which Copper or Iron melts, they become hard, ſemitranſparent, and ſonorous like the hard mineral ſtones. This curious experiment deſerves to be further proſecuted.

neral

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neral diviſion, as horns or bones, can be obtained only from an actual examination of a number of the particular ſubſtances belonging to each diviſion, I have choſen for the ſubjects of this examination thoſe ſubſtances to which ſome conſiderable medicinal virtues have been attributed, or which are employed for mechanic uſes. Thus the experiments anſwer a double end: At the ſame time that they ſhew, by particular examples, the chemical conſtitution of this or that kind of bodies, they enable us alſo to form ſome judgment about the medical uſes of the particular bodies. We ſhall find from them, that many of thoſe ſubſtances, to which phyſicians have aſcribed great virtues, and on which they have had ſome dependence even in caſes of importance, contain ſo much of a mere earth, give out ſo little to the force of boiling water or ſpirit, and this little of ſo inſignificant qualities, that their virtues may very juſtly be queſtioned.

I. OX-BONE.

OF the thigh-bone of an Ox, four drams, finely raſped, were thoroughly boiled in diſtilled water. The decoction, evaporated, left four ſcruples of a yellowiſh extract, which was found to be little other than Sea-ſalt. Rectified Spirit of Wine, long digeſted, and boiled upon the raſped bone, extracted from four drams, no more than half a grain. The bone remaining after the action of water, appeared unchanged in colour; but that which had been boiled in ſpirit, looked reddiſh.

The acid ſpirits of Vitriol, Nitre and Sea-ſalt, totally diſſolved it: The ſolution made in the vitriolic acid was yellowiſh, and ſhot into fine white cryſtals: Thoſe made in the nitrous and marine were colourleſs. Alcaline liquors had little effect; Spirit of Sal ammoniac had none at all; and fixed alcalies, and cauſtic Ley, did but ſlightly corrode the bone: The volatile ſpirit received no colour; the cauſtic ley a yellowiſh one.

Two ounces of Ox-bone, diſtilled in a retort, in an open fire, gave over two drams of an empyrumatic phlegm, one dram of volatile urinous ſpirit, two ſcuples of volatile Salt, and two ſcruples of fœtid

OX BONE. Oil: The Caput mortuum weighed one ounce drams and two ſcruples.

In another diſtillation of Ox-bone, I obtained from ſixteen ounces of the bone, eight ounces and a half of diſtilled matter; of which the urinous ſpirit made up four ounces ſix drams and a half, the volatile Salt half a dram, and the empyreumatic Oil, three ounces five drams. The Caput mortuum weighed ſix ounces ſeven drams, and loſt in calcination three drams: From the calx were elixated by water, twenty-ſeven grains of fixed Salt.

II. HART'S HORN. The branched horns of the HART or male red Deer (the female has none) are on their firſt appearance quite ſoft, and covered on the outſide with a woolly matter: By degrees they contract a ſkin, which as the horn grows dry and hard, peels off. This animal ſheds his horns every year; not as ſome ſuppoſe, from their mere weight, ſince they fall regularly at a certain ſeaſon: nor from want of nouriſhment, ſince the moſt plentiful ſupply of food does not prevent it: nor from the young horns puſhing out the old, for when the horns are ſawed over ſhort, the ſtumps never fall off; but ſolely, as Stahl has obſerved, from the action of cold, for young Harts, kept in warm ſtalls in the winter, do not loſe their horns.

Sixteen ounces of Hartſhorn, boiled with water, gave three ounces and three drams of ſtrong firm gelly or gelatinous extract: From the reſiduum, rectified ſpirit extracted nothing. Spirit applied at firſt took up about four ſcruples from ſixteen ounces; this extract conſiſts not wholly of oily, but of oily and gelatinous matter.

From twenty-eight pounds of Hartſhorn distilled in an open fire, were obtained near five pounds and a half of a ſomewhat oily and urinous phlegm, thirty ounces of a volatile Salt, and above a pound of empyreumatic Oil (*b*): The remaining Coal or Caput mor-

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(*b*) *Produce of Salt, &c.*] The authors experiments were made upon the cortical part or tips of the horns, which contain more gelatinous matter, and yield a larger quantity of Volatile Salt, than the internal me-

HARTſHORN.

[illegible]um weighed near ſeventeen pounds. The coal burnt to whiteneſs, diſſolves both in the nitrous and marine acids, and is precipitated from them by the vitriolic: An ounce of Spirit of Salt diſſolved, without much effervеſcence, two drams twenty-one grains; and an ounce of good Spirit of Nitre, three drams twenty-eight grains.

The Jelly, volatile Salt, Spirit, and rectified Oil of Hartſhorn, are of more frequent uſe in medicine than thoſe of any other animal ſubſtance. Hartſhorn has been a particular favourite among the pharmaceutical chemiſts: Even its dead, fixed, indolent earth, deprived of all the active principles of the horn, has been celebrated as a medicine of extraordinary virtue.

Some prepare this earth, by ſuſpending the tips of the horns in the head of a ſtill during repeated diſtillations of ſimple waters, till the aqueous vapour has extracted the gelatinous parts, and rendered the horn pulverable; in which ſtate it is called Hartſhorn *philoſophically* prepared, or prepared *without fire*. Others boil the horn in water directly; and thus obtain, more expeditiouſly, a preparation juſt as philoſophical, and juſt as uſeleſs.

The horn calcined to whiteneſs in an open fire, and levigated into a fine powder, called ſimply *prepared Hartſhorn*, is ſtill more perfectly diveſted of its gelatinous parts, and reduced to a pure earth: This is ſometimes made an ingredient in powders for cleaning the teeth: It may likewiſe be of uſe for obtunding acid humours in the ſtomach, like other abſorbent earths; but on what pretence can we aſcribe to it cordial, diaphoretic, alexipharmac, or antifebrile powers? Some endeavour to improve the medicine, by grinding

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medullary ſubſtance. On diſtilling a quantity of fragments of Hartſhorn conſiſting chiefly of pith, I found the proportion of volatile Salt to be only about half as much as in our author's experiment; five hundred and three pounds of the horns having yielded only ſixteen pounds of rough Salt, with ninety-two pounds of rough Spirit and Oil.

The rough Salt of Hartſhorn loſes in rectification between one third and one half of its weight. Two pounds three ounces, on been rectified with Spirit of Wine, were reduced to one pound four ounces and a half.

HARTS HORN

the earthy powder with Gold-leaf, and calcining the mixture till it acquires a purple colour: This preparation was formerly kept a ſecret; and if it was now forgotten, medicine would ſuffer no loſs.

III.
CRANIUM HUMANUM.

HALF an ounce of the *Cranium Humanum* raſped, gave, with rectified Spirit of Wine, two grains of an extract, which had no ſmell, and no particular taſte. The ſame quantity, treated with water, gave a dram of gelatinous extract, inodorous like the other, but in taſte ſomewhat ſaline. Spirit of Vitriol, and Spirit of Sea-ſalt, totally diſſolved the bone; but Spirit of Nitre left a ſmall portion undiſſolved: All the ſolutions were colourleſs; that made in the vitriolic acid ſhot into fine ſmall white cryſtals. Spirit of Sal ammoniac had no effect; ſolution of fixed Alcali corroded a little; and cauſtic Ley diſſolved almoſt the whole: Theſe alcaline liquors received no tincture any more than the acids.

By gradual diſtillation in a retort, I obtained from two ounces of the *Cranium*, of urinous liquor three drams and a half, of empyreumatic Oil half a dram, and of volatile Salt half a dram: The Caput mortuum weighed eleven drams and a half.

This bone, the natural defence of the ſeat of ſenſation and perception in the nobleſt animal, has been recommended medicinally as a cure for epilepſies, deliria; and all diſorders of the ſenſes —— from the ſame philoſophy, which aſcribed antiaſthmatic virtues to the lungs of the long-winded Fox; and expected, becauſe fowls are ſaid to digeſt even ſmall ſtones, that the ſkin of the gizzard, dried and powdered, would produce a ſimilar effect in the human ſtomach —— To ſuch lenghts of extravagance have the ſons of phyſick been carried by the blind ſuperſtition of former ages!

IV.
BOAR'S TUSK.

HALF an ounce of the TUSK of the WILD-BOAR, digeſted and boiled in rectified Spirit of Wine, gave three grains of extract, of a rancid taſte. The ſame quantity yielded with water half a dram; this extract gave out marine vapours on the affuſion of

Oil

BOAR'S TUSK.

Oil of Vitriol, and was found to conſiſt chiefly of common Salt. The bone after boiling in ſpirit, looked reddiſh; but water made no change in the colour.

This bone was totally diſſolved by Spirit of Vitriol and Spirit of Nitre, and almoſt totally by Spirit of Salt; to the firſt it communicated a yellowiſh tinge, to the two latter none; from the firſt it cryſtallized, in form of a ſubtile Salt. Spirit of Sal ammoniac had no action on it; ſolution of fixed alcaline Salt corroded a little of it, without acquiring any colour; cauſtic Ley corroded almoſt the whole, and appeared of a pale Roſe-red.

From two ounces of the Tuſk, diſtilled in an open fire, there aroſe five drams and a half of urinous liquor, two ſcruples of empyreumatic Oil, and a dram and a half of volatile Salt: The reſiduum weighed one ounce and a ſcruple.

V. HIPPOPOTAMUS.

THE HIPPOPOTAMUS is an amphibious quadruped, inhabiting chiefly the large rivers of Africa and Aſia, as the Nile, the Niger, the Bamboth, the Zaire in the kingdom of Congo, *&c.* He is called *Hippopotamus* or river-*horſe* from the ſhape of his head, *Bupotamus* or river-*ox* from the hinder part of the body, and the river-*elephant* from the ſize of his fore teeth. Bochartus edeavours to prove that this animal is the *Behemoth* mentioned in Job. When full grown, he is thirteen feet long, and twice as thick in the body as an Ox; the legs are ſhort and thick; the head is three feet in length and very thick, the mouth above a foot wide: The ſkin is remarkably ſtrong, being half an inch in thickneſs when dry, and hence it is uſed in ſhields for defence: A piece of the ſkin and ſome other parts of the animal are preſerved in the Muſæum of the Royal Society.*

The fore-teeth of the River-horſe are for the moſt part bent ſemicircularly, ſtriated longitudinally on the ſurface, with a deeper furrow in the curvature. They are hollow internally, but leſs and leſs ſo towards the extremity which is pointed nearly like the tuſk of the wild Boar. They are of different ſizes: The largeſt weigh

HIPPOPOTAMUS.

weigh four pounds. They are extremely comp[illegible] ſo hard as to ſtrike fire with good Steel; externally of a yellowiſh-white colour, unleſs tarniſhed by age, or filth adhering to the unequal ſurface; internally of [illegible] fine white, which is leſs apt to change to a yellow than that of other bones. From their compactneſs and durable whiteneſs, they are employed like Ivory, for ſundry mechanic uſes.

This bone contains little oily or inflammable matter. From half an ounce, raſped into powder, I obtained, by digeſtion and boiling with Spirit of Wine, no more than one grain of extract, which was of a blackiſh-brown colour, and had very little taſte or ſmell. The ſame quantity being boiled with water, and the decoction evaporated, there remained thirty grains of a yellowiſh maſs, tenacious like Glue, and to the taſte quite ſaline. The bone remaining after the action of both menſtrua appeared unchanged in colour.

Spirit of Vitriol totally diſſolved it: Spirit of Nitre and Spirit of Sea-ſalt left a little flaky matter: The ſolutions in the vitriolic and marine acids looked yellowiſh, that in the nitrous, colourleſs: From the firſt, a ſmall quantity of ſaline matter cryſtallized. Spirit of Sal ammoniac, ſtrong alcaline Ley, and cauſtic Ley, corroded a little of the bone, and acquired a yellowiſh tinge.

Two ounces diſtilled in a glaſs retort, at firſt with a ſand-heat and afterwards with an open fire gradually increaſed, yielded four drams and a half of a volatile urinous empyreumatic liquor, and half a dram of a reddiſh-black empyreumatic Oil: The remaining coal weighed ten drams two ſcruples. During the diſtillation, an actual volatile Salt concreted about the ſides of the receiver, but on continuing the proceſs it was diſſolved and waſhed down, its quantity being too ſmall to be collected in its ſolid form.

VI.
SEA-HORSE.

THE tooth of the SEA-HORSE has been generally confounded with that of the River-horſe, and ſubſtituted for it in the ſhops. The Sea-horſe, *Roſmarus, equus marinus, leo marinus, elephantus marinus*, is a large

SEA-HORSE.

[illegible]phibious marine quadruped, found in the northern ſeas, about the coaſts of Greenland, Iceland, and Nova Zembla: It is called by the Germans the Horſe-whale. The teeth of this animal are naturally of a fine white, though we commonly meet with them tarniſhed to a yellowiſh: They are very hard and compact, more or leſs bent, pointed at the end like thoſe of the River-horſe, but leſs hollow, the hollowneſs reaching only a little way from the root: The largeſt weigh three pounds and a half. The ſkin of one of theſe animals has been known to weigh five hundred pounds. The tooth is uſed as Ivory, not only by the northern nations, but likewiſe among the Turks, Coſſacks, Perſians, *&c.* for ſword-hilts, hafts of knives, and a variety of toys. The teeth both of the Sea and River-horſes are made alſo into rings, necklaces, bracelets, *&c.* from a whimſical conceit of their being good againſt cramps.

From half an ounce of the fine raſpings of the tooth of the Sea-horſe, I obtained, by digeſtion and coction in Spirit of Wine, only half a grain of extract; and this ſeemed to proceed rather from ſome extraneous foulneſs adhering to the bone than from the bone itſelf; it was of a browniſh colour, and had neither taſte nor ſmell. Another half ounce, boiled with diſtilled water, yielded twenty-five grains of a glutinous tenacious maſs, of a yellowiſh-white colour and ſaline taſte. The bone itſelf ſuffered no change in its colour either from water or ſpirit.

All the mineral acids diſſolved it; with this difference, that the nitrous and marine left a ſmall quantity of flaky matter, whilſt the vitriolic took up the whole: From the vitriolic ſolution a little white cryſtalline ſubſtance ſeparated, as from the ſolutions of other bones made in that acid. The nitrous ſolution looked yellowiſh. Alcaline menſtrua had no effect, except that a ſolution of fixed Alcali made the powder grey and blackiſh.

From two ounces of the raſped bone, diſtilled in a glaſs retort, at firſt in ſand and afterwards in an open fire gradually raiſed, were obtained a dram and a half of clear water, two ſcruples and a half of urinous, oily, SEA-HORSE.

empyreumatic liquor, two ſcruples of reddiſh-black fetid Oil, and a dram and a half of fine cryſtalline volatile Salt: The Caput mortuum weighed one ounce three drams and a half.

This tooth differs therefore, chemically, from that of the *Hippopotamus*, in giving out leſs to water and to ſpirit, and nothing to alcaline liquors; in being changed to a blackiſh grey colour by ſolution of fixed Alcali; tinging the nitrous acid yellow, and not the vitriolic; yielding in diſtillation leſs urinous liquor, more Oil and Caput mortuum, and much more volatile Salt, and not only an actual fetid ſalt, but what is remarkable, a cryſtalline one.

VII. IVORY.

IVORY is a tuſk, or tooth of defence, growing at each ſide of the jaw of the male Elephant; the female has only the ſmaller grinding teeth. The Elephant is diſtinguiſhed from other animals by its ſize, its tuſks, its trunk or ſnout, (which it lengthens, ſhortens, and bends at pleaſure, and uſes as a hand,) and its thick roundiſh hoofs. It is the largeſt of all land animals, and remarkably docile. In Aſia and Africa, its native climates, great numbers are tamed and trained up by the grandees, for war, for carriage, for amuſement, and for ſhow. Du Verney diſſected an Elephant at Paris in 1681, and an abſtract of his obſervations is publiſhed in Du Hamel's hiſtory of the Academy of Sciences; but a much better and more particular anatomical deſcription of this animal may be ſeen in Ray's hiſtory of Quadrupeds.

The Elephant's tuſk is accounted by ſome not to be a tooth but a horn; becauſe, ſay they, it ſoftens in the fire, which horns do and teeth do not. Ivory, however, does not grow ſoft like common horn, but continues brittle, and by degrees calcines: Of horns, in the common ſenſe of the word, it is no character to grow ſoft in the fire; for thoſe of ſeveral animals, as the Hart and the Elk, do not. Ivory is a true and perfect tooth, and the largeſt tooth in the world. Sometimes it grows to an enormous ſize: Vartomannus ſaw two in Sumatra which weighed together three hundred and thirty-ſix pounds; and Linſchott mentions

IVORY.

mentions a ſingle one which weighed above two hun[illegible] pounds. The moſt common ſize, however, in trade, is from four to fifteen pounds, the very large ones being kept as curioſities.

The entire tooth is of a yellowiſh, browniſh, and ſometimes a dark brown colour on the outſide, internally white, hollow towards the root, and ſo far as was inſerted into the jaw of a blackiſh brown colour. The fineſt, whiteſt, ſmootheſt, and moſt compact ivory, comes from the iſland Ceylon. The grand conſumption of this commodity is for making ornamental utenſils, mathematical inſtruments, caſes, boxes, balls, combs, dice, and an infinity of toys. There are many exquiſite pieces of workmanſhip, as medals and chains, curious ſpinning-wheels, *&c.* made entirely out of one tooth. In his Pruſſian Majeſty's collection, there is a chair, a pair of cheſs tables, and ſundry other curioſities of ivory. The workmen have methods alſo of tinging it of a variety of colours.

Four drams of raſped ivory yielded, with rectified Spirit, three grains of extract, in taſte ſomewhat rancid, but of no ſmell. The remainder inclined a little to reddiſh. On boiling four drams in pure diſtilled water, and inſpiſſating the decoction, I obtained ſix drams of jelly or a gelatinous extract; but as the dried reſiduum weighed three drams and a ſcruple, it is plain that in the ſix drams of jelly there were only two ſcruples afforded by the ivory, all the reſt being water; and hence we learn, what a large proportion of water is retained in jellies. The jelly taſted manifeſtly ſaline; the remaining ivory proved conſiderably brittle and earthy.

Spirit of Vitriol totally diſſolved raſped ivory; from the ſolution there ſeparated an elegant, white, ſparkling, ſilky, cryſtalline mixt, in appearance reſembling a ſalt, but neither ſaline to the taſte, nor diſſoluble in water; of the ſame kind alſo are the cryſtals obtained by this acid from the other ſolid parts of animals: The liquor, floating above the cryſtals, is apt to become yellowiſh, and at length brown.

IVORY.

Spirit of Nitre and Spirit of Salt likewiſe diſſolved the whole of the ivory, but received no colour, [illegible] yielded no cryſtals. Spirit of Sal ammoniac had no effect: Alcaline Ley corroded a little of the ivory, without acquiring any tinge: Cauſtic Ley totally corroded it, and became ſomewhat yellowiſh.

Lemery ſays that ivory contains much Oil, volatile Salt and Earth, but little Phlegm: I have found on the other hand, that the Oil is in the ſmalleſt quantity of all theſe principles, and that the Phlegm is in larger quantity than either the Oil or Salt. From two ounces, diſtilled in a retort, I obtained three drams and a ſcruple of liquor, of which the firſt two drams ſmelt like ſope, and the reſt empyreumatic and urinous: This was ſucceeded by two ſcruples of fetid Oil, and two drams of volatile Salt. The remaining coal weighed ten drams.

Ivory black.

The coal of Ivory is of a fine deep black colour; and hence is uſed as a pigment by the painters under the name of Ivory-black; as alſo by the lapidaries, as a foil for precious ſtones; and by the japanners and varniſh makers, as an ingredient in their black compoſitions. There are particular machines and contrivances for burning the Ivory for theſe purpoſes; by which the colour is rendered more beautiful than that of the coal which remains in the diſtillation.

If the Ivory-black be calcined in the open air, it changes into an earth of extreme whiteneſs: By deflagrating two parts of raſped Ivory with three of Nitre, it is quickly reduced into a ſimilar white powder, without any intermediate ſtate of blackneſs.

VIII. CARP-STONE.

THE CARP-STONE, *Lapis carpionum*, is found in the head of a fiſh, which is not the common carp, but the gilt charr, the *cyprinus* of Rondeletius. It is not, what Lemery calls it, the *os hyoides*, but a bone lodged in the *acetabulum*, at the juncture of the back-bone with the head. When freſh, it is moderately tranſparent, like horn, in colour whitiſh or yellowiſh; by keeping it becomes more and more yellow and brown. In figure it is flat, and irregularly triangular.

CARP-STONE.

Half an ounce of this bone, raſped ſmall, yielded with rectified Spirit of Wine five grains of extract, which taſted and ſmelt quite rancid, like old dry fiſh. From the ſame quantity, boiled in water, I obtained a dram of extract, of a yellow colour, in taſte purely ſaline, without any ſmell. The bone remaining after the action of Spirit, looked like tranſparent yellow amber; that which had been boiled in water looked grey.

Spirit of Vitriol corrodes only a little of the bone, and by that little is rendered turbid: Spirit of Nitre diſſolves nearly the whole, and acquires a yellow colour: Spirit of Salt diſſolves a little, and becomes likewiſe yellow. Spirit of Sal ammoniac has no effect: Alcaline Ley corrodes a little, receives no colour itſelf, but makes the bone black: Cauſtic Ley diſſolves and corrodes a part, and acquires a yellow tinge.

Two ounces of the bone, diſtilled in a glaſs retort, in an open fire gradually raiſed, gave over half an ounce of liquor, of which the firſt three drams had an extremely ill ſmell, but the fourth the common urinous empyreumatic one: Then aroſe a dram and a half of fluid Oil, three drams of a thicker one, and three drams and a half of volatile Salt: The remaining coal weighed half an ounce.

IX. PERCH-STONE.

THE PERCH-STONE, *Lapis percarum*, is a ſmall flat oval bone, hollowed a little at one ſide, in figure ſomewhat reſembling a flatted grain of Rice, of a gloſſy whiteneſs; found in the head, near the origin of the back-bone, not of the common Perch (*Perca major*) but of the ruff (*Perca minor, cernua, aſpredo.*)

Half an ounce of this bone, reduced to powder, yielded with rectified ſpirit only half a grain of extract, which had neither ſmell nor taſte. The ſame quantity gave with water two ſcruples and a half of a yellowiſh maſs, which was almoſt mere Salt. The bone itſelf ſuffered no change in its appearance from either menſtruum.

Spirit of Vitriol and Spirit of Salt, totally diſſolved the bone; Spirit of Nitre left a ſmall matter undiſſolved: The firſt acquired a yellowiſh colour and depo-

PERCH-STONE.

ſited elegant cryſtals; the two others received no tincture, and yielded no cryſtals. Spirit of Sal ammoniac, alcaline Ley, and cauſtic Ley, corroded very little, and were not ſenſibly tinged.

In theſe experiments, the Perch-ſtone diſcovers no conſiderable differences from other bony ſubſtances; but its analyſis by fire is very ſingular and remarkable. Two ounces diſtilled in a glaſs retort, at firſt in a ſand-heat, and afterwards in an open fire, gave over bare half a dram of a clear liquor, juſt verging to yellowiſh, in ſmell only ſlightly volatile and empyreumatic: The greateſt force of fire would raiſe nothing more: There was neither Oil, nor volatile Salt, nor hardly any marks of an animal nature. The Caput mortuum however was a black coal, like that of other bones; it weighed two ounces as at firſt, wanting only the half dram of phlegmatic liquor.

X. Jaw of the PIKE.

THE PIKE is a freſh water fiſh of prey, with teeth only in the lower jaw, ſaid to be of great longevity, and to grow by age to a prodigious ſize: I have ſeen ſome of thirty and thirty-two pounds weight. There are none of theſe fiſhes in Spain; nor any name for them in that language.

Half an ounce of the lower jaw-bone of the Pike, reduced into powder, yielded with rectified ſpirit five grains of extract, of a rancid taſte, without any ſmell; the remaining powder looked reddiſh. From the ſame quantity were obtained by water three ſcruples and a half of a greeniſh-yellow maſs, conſiſting of a glutinous ſubſtance mixed with a large proportion of common Salt; the reſiduum appeared unaltered.

The vitriolic and nitrous acids totally diſſolved the bone; the marine left a ſmall portion undiſſolved: The ſolutions made in the two laſt were colourleſs; that in the firſt was yellowiſh, and depoſited a little cryſtalline matter. Spirit of Sal ammoniac, common alcaline Ley, and cauſtic Ley, corroded only a little, and received no colour.

From two ounces, diſtilled in a glaſs retort in an open fire, there aroſe a dram and a half of liquor of a lixivial ſmell, four ſcruples of liquor of the uſual empyreumatic ſmell, a dram of empyreumatic Oil, and a dram and a half of volatile Salt: The Caput mortuum weighed ten drams and a half. JAW of the PIKE.

XI. LAPIS MANATI.

THE MANATI or Sea-cow is a large animal, of a peculiar kind. It is ſtrictly an inhabitant of the ſea, but cannot live long without freſh water, and feeds on graſs and other vegetable matters; hence it is never ſeen but near the mouths of large rivers. It is met with in various parts of Aſia, Africa and America; but in none of the European ſeas. It has two very ſhort legs, which ſerve rather as hands than as feet, for though called amphibious, it never comes entirely on ſhore. It is very harmleſs, and eaſily caught. The female is viviparous, ſuckles her young like thoſe of the human ſpecies, and carries them conſtantly in her paws; hence it is called by the Spaniards and Portugueſe *la Donna*. The fleſh is ſaid to be much eſteemed in America, and the ſtrong ſkin to be uſed as a defence againſt the arrows of the Indians.

Certain bones found in the head of this animal, called *Lapides manati*, are expected to be kept in the ſhops for medicinal uſe; and the druggiſts do not fail to ſupply us with a great variety of bony ſubſtances under this name, very different from one another both in figure and in ſize, and none of them the genuine bones of the Manati: Hence the different accounts of the *Lapis manati* given by authors; ſome deſcribing it as of the ſize of a Hazel-nut, and others as large as a child's head. The Dutch put off cod's-head bones for thoſe of the Manati, and aſſure us that they come from America.

AS the true *Lapis manati* is not in this country to be procured, I examined the ſubſtance which is moſt generally ſubſtituted for it, namely the ear-bone of the Whale.

From half an ounce of this bone, by digeſtion and coction in rectified ſpirit, I obtained only one grain of an extract which had neither ſmell nor taſte: From the ſame quantity treated with diſtilled water, I got a dram of a yellowiſh maſs, which had no ſmell but a

Lapis Manati. very ſaline taſte, and which in effect was little other than mere common Salt. The powder ſuffered no change in colour from either menſtruum.

Spirit of Vitriol totally diſſolved the bone, depoſited a fine white cryſtalline matter, and became yellowiſh. Spirit of Nitre and Spirit of Sea ſalt diſſolved nearly the whole, without receiving any colour. Spirit of Sal ammoniac had no effect. Common alcaline Ley, and cauſtic Ley corroded a little of the bone, but continued colourleſs: The powder remaining after the action of the plain Ley, looked blackiſh.

From two ounces of the bone, diſtilled in an open fire, I obtained a dram of phlegm of a lixivial ſmell, a dram of a volatile ſpirit or empyreumatic urinous liquor, half a ſcruple of fetid Oil, and half a dram of volatile Salt: The remaining coal weighed thirteen drams and a ſcruple.

XII. Talus Leporis. HALF an ounce of the ANCLE-BONE of the HARE, *Talus leporis*, yielded with rectified ſpirit fifteen grains, or one ſixteenth its weight, of an unctuous, yellowiſh-brown, tranſparent extract, of a rancid taſte and ſmell. Another half ounce, treated with water, gave a dram of a yellowiſh matter, which had no ſmell, and was almoſt mere Salt. Both the reſidua were of the ſame colour as at firſt.

By Spirit of Vitriol it was corroded; a part ſeparated in a cryſtalline form, and the reſt was reduced into a white powder. The Spirits of Nitre and Sea-ſalt totally diſſolved it; the ſolutions were clear, with an unctuous matter on the ſurface, which in the nitrous acid was white, in the marine of a browniſh-yellow. Spirit of Sal ammoniac had no effect, except that it acquired a ſlight yellowiſh tinge, with a kind of cloudineſs towards the ſurface, as if a fine powdery ſubſtance was ſuſpended in it. Strong alcaline Ley took up more of the bone and became yellower: Cauſtic Ley did not ſeem to diſſolve ſo much.

Two ounces diſtilled in a glaſs retort, at firſt in ſand and afterwards in an open fire, gave over two drams of a liquor of a quite ſopy ſmell, one dram of

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an empyreumatic urinous liquor or ſpirit, four ſcruples of empyreumatic Oil, and two drams of volatile Salt: The Caput mortuum weighed nine drams two ſcruples.

TALUS LEPORIS.

XIII. UNICORN'S HORN.

THE UNICORN is not a land animal of the Horſe kind, as ſome have repreſented it, but a ſpecies of Whale common in the northern ſeas, called by the Icelanders *Narhual* or *Narwal*, that is the Carrion-whale, its food being the carcaſſes of men and fiſhes. The horn, as it is called, is a large tooth fixed in the upper jaw: As the tuſks of the Sea-horſe are bent downwards, and thoſe of the Elephant, the Boar, and the oriental Wild boar called Babyrouſſa, upwards; that of the Narwal ſtands horizontally, and in this reſpect only it differs from the fangs of thoſe animals.

The tuſk of the Narwal is very large; ſome have been ſeen of the length of nine or ten feet. It is pointed at the end, ſometimes irregularly crooked, in colour more or leſs white, generally wrinkled and undulated as if the bone was twiſted, ſometimes, but very rarely, of a ſmooth poliſhed ſurface. The part that had been inſerted into the jaw, is commonly of a yellower or browner colour, and more unſightly, than the reſt. Towards the root, there is often a conſiderable part hollow: I have been aſſured by the maſter of a Greenland veſſel that the hollow teeth are decayed ones which the animal has ſhed, and that the ſound ones taken immediately from the Whale, are ſolid throughout. This tooth, like other bones, is made into various toys and utenſils: The Greenlanders uſe the tips for pointing their hunting weapons.

Half an ounce of this bone, raſped into powder, yielded with rectified ſpirit, two grains of an inſipid and inodorous extract. From the ſame quantity were obtained by water, three ſcruples and a half of a browniſh-yellow, tenacious, unctuous maſs, of a ſaline taſte without any ſmell. The reſiduum, in both caſes, was of the ſame appearance as at firſt.

All the mineral acids totally diſſolved the bone, without receiving from it any colour; from the ſo-

UNICORN'S HORN.

lution made in the vitriolic, a little cryſtalline matter ſeparated. Spirit of Sal ammoniac and alcaline Ley had no effect; cauſtic Ley corroded a little of the bone.

By diſtillation in a retort, in an open fire, I obtained from two ounces of the bone, of urinous ſpirit four drams, of an empyreumatic Oil half a dram, and of volatile Salt two ſcruples and a half: The Caput mortuum weighed ten drams two ſcruples.

SECTION VI.

Earthy Parts of ANIMALS.

EARTHY.

HORNS and bones conſiſt in great part of an earth, but are nevertheleſs very diſtinct from the bodies of the preſent diviſion. The earthy parts of animals, more ſtrictly ſo called, are of a much leſs compact texture than the horny and bony; and want not only the flexibility of the one, but the hardneſs of the other. They break far more eaſily by a blow; and are reducible in the mortar into powder. They yield in general leſs oily and ſaline matter in diſtillation, and contain in their natural ſtate leſs gelatinous matter; whence they diſſolve, not only in the ſtrong mineral acids, but in the milder acids of the vegetable kingdom, the gelatinous parts being inſufficient to cover and defend the earth from the action of the acids.

Of this kind are moſt of the teſtaceous and cruſtaceous coverings of animals, and many calculous concretions. The pure earthy part is not in all theſe ſubſtances the ſame, nor are the particular differences ſufficiently known. The only conſiderable difference that has been obſerved, is, that ſome are converted by fire into a ſtrong quick lime, whilſt others ſuffer no ſuch change: [See page 318.]

CLASS

CLASS I.

Earthy Subſtances not convertible by Fire into Quicklime; and whoſe Earth ſeems to be ſimilar to that of Bones and Horns.

PEARL. OF all the ſubſtances of this claſs, and indeed of all the earthy parts of animals, the moſt valuable and remarkable is the PEARL; which from its beauty and luſtre is ranked among the precious ſtones, though it has nothing of their diſtinguiſhing hardneſs.

Pearl is no other than a calculus, or morbid concretion, produced in a certain ſhell-fiſh of the Oyſter-kind, and ſometimes in common Oyſters and Muſcles: It is ſometimes formed upon the inſide of the ſhell, and ſometimes in the body of the animal. Shells in general appear to proceed from peculiar nutritious juices, regularly ſecreted and indurated; and Calculi, from a redundance of thoſe juices, or a ſtagnation and unequal diſtribution of them occaſioned by an obſtruction of the veſſels.

Pearl-fiſhery. The Mother-of-Pearl fiſh, or Pearl oyſter, is an inhabitant of the bottom of the ſea: There it abides fixed, and is not to be come at but by diving. A number of ſmall ſhips is generally engaged together in this dangerous buſineſs, on ſuch particular ſpots as have been found to be rich in the Pearl-fiſh, and at certain ſeaſons of the year. The divers are let down by ropes, and immediately drawn up again upon their pulling a bell as a ſignal for that purpoſe. Machines have been contrived for enabling them in ſome degree to breathe at the bottom, by means of pipes reaching above the ſurface and communicating with the external air, or by a quantity of air included and carried down with them: See ſome papers upon this ſubject in the Philoſophical Tranſactions. Suffocation however is not the only danger to which the divers are expoſed: They are ſubject to ruptures of ſome of the veſſels from the vaſt preſſure of the water at

PEARL. at great depths, and to be wounded or devoured by fiſhes of prey, which ſome of the rich beds of Pearl-fiſh are ſo much infeſted with, that ſcarcely any one can venture down at all.

After the Pearl-oyſters have thus been got up, there ſtill remains a proceſs, not a little prejudicial to health, and extremely offenſive. If the ſhells were opened directly by any violent means, the Pearls, ſaid to be at this time in a ſomewhat ſoft ſtate, would be liable to be injured and become of little value. The whole are therefore laid in heaps, till the ſhells open ſpontaneouſly, and the fiſh putrefies; after which the corrupted cadaverous matter is ſearched diligently for the Pearls, which are often too few to pay the expence of the proprietors, much leſs to make any recompence to the workmen for a ſervice ſo loathſome and ſo hazardous.

Different ſorts and places of production.

Pearls are uſually divided into oriental and occidental; the firſt produced in Aſia and Africa, the latter in America and Europe. The principal oriental Pearl fiſheries are in the Perſian gulf and on the coaſts of Perſia and Arabia, of which a chart may be ſeen in Kæmpfer's *Amænitates Exoticæ*; near the iſlands Ceylon, Manaar, Sumatra, Java, and Borneo; on ſome of the coaſts of Japan; between Banana and Cochin, off Cape Comorin, and in other parts along the Malabar coaſt, as particularly at Tutogrin or Tutocoryn, where there is an excellent Pearl bank in poſſeſſion of the Dutch. The moſt remarkable Pearl-fiſheries of America are in the gulf of Mexico, along the coaſt of New Spain, off St. Margarite or the pearl-iſland, in the Rio de la Hacha, at the iſlands St. Martha, Quibo, Gorgonia, &c. In Europe, Pearls are now and then met with on the coaſts of Scotland, Livonia, Courland, in the river Ilts in Bohemia, in the Regen in Bavaria, in certain lakes near Augſburg, and in ſundry other places.

The oriental Pearls are accounted the beſt; and, conſidered collectively, they certainly are ſo, though this ſuperiority by no means extends to all the individuals: There are ſome among the occidental, of exquiſite luſtre and great value; and many millions among the oriental, coarſe and unſightly.

PEARL.

Even among the better kinds of oriental Pearls, there are very conſiderable differences: Borneo affords the largeſt, and Ceylon and Manaar the whiteſt. Thoſe of Sumatra, Java, Banana, Cochin, and the Malabar coaſt, are for the moſt part ſmaller and leſs fine: Thoſe of the Perſian gulf have generally ſomewhat of a yellowiſh caſt, but as they conſtantly retain this tinge, and have an excellent luſtre, they are accounted the beſt, and ſome confine the name of oriental to theſe alone.

There are Pearls of various colours, figures, and magnitudes of an exquiſite Silver-like brightneſs, ſemitranſparent, opake, opal-coloured, yellow, greeniſh, bluiſh, greyiſh, reddiſh, browniſh, blackiſh, rainbow-coloured; round, oval, conical, cylindrical, angular; from the ſize of a Millet-ſeed or leſs, to that of a hazel-nut and more: It is obſervable that the large ones approach generally to the figure of a Pear. The largeſt Pearl hitherto known is deſcribed by Tavernier, and is in the poſſeſſion of the King of Perſia; it was found at Catifa in Arabia, and coſt 1,400,000 French Livres. Some years ago, there were two very large ones to be diſpoſed of at Leipzick, weighing together above ninety carats: The author above-mentioned had one that weighed fifty-five carats: A carat is three grains and a half. I have ſeen a Pearl in the Engliſh crown, which is ſaid to be worth ten thouſand pounds ſterling. Sir Robert Sibbald ſays in his *Scotia Illuſtrata*, that Pearls have been found in Scotland of a very large ſize.

Their valuation.

Pearls are valued from their roundneſs, their ſize, ad their water, that is their luſtre and purity. Their weight is eſtimated in Europe by carats; in Perſia by *abas's*, and in Golconda and Vilapour by *ratis*, each abas and rati being one eighth part leſs than a carat.

The weight of round pearls is expeditiouſly judged of, by means of a ſmall inſtrument compoſed of

PEARL. ſeveral ſlips of Braſs full of holes of different ſizes: The ſmalleſt hole receives a pearl of one or two grains; and the largeſt, one of ten carats; and thus the weight of any given round Pearl is known from the hole which it fits.

Small irregular ones are valued from the number that goes to an ounce: If a hundred make an ounce, they are valued at an hundred rixdollars; if the number is leſs, the price is greater: and if the number is greater the price is leſs: Two hundred to the ounce coſt but ſeventy rixdollars; three hundred, fifty; nine hundred, ten; two thouſand, three; four thouſand, two and a half: Of the very ſmall ſort called Seed-pearls, uſed in medicine, an ounce contains uſually eight or ten thouſand, and coſts, if the Pearls are of the oriental kind, two rix-dollars, if occidental one rixdollar and twelve groſchen (*c*).

Cleaned. Attempts have been made to take out ſtains from Pearls, and to render the foul opake coloured ones equal in beauty and luſtre to the oriental. Abundance of proceſſes are given for this purpoſe in books of ſecrets and travels: but they are very far from anſwering what is expected from them. Pearls may be cleaned indeed from any external foulneſs, by waſhing and rubbing them with a little Venice Sope and warm water, or with ground Rice and Salt, with Starch and Powder-blue, with Plaſter-of-Paris, with white Coral, with white Vitriol and Tartar, with Cuttle bone, Pumice-ſtone, and other like ſubſtances; but a ſtain that reaches deep into the ſubſtance of the Pearl is impoſſible to be taken out. Nor can a number of ſmall Pearls be united, as ſome pretend, into a maſs ſimilar to an entire natural one.

Artificial. There are, however, methods of making artificial compoſitions, equally ornamental with the natural Pearls, and difficultly if at all to be diſtinguiſhed from them by the eye. Moſt of theſe are prepared in France and Italy, and ſome in Spain: The beſt conſiſt of a hollow glaſs ball, blown by a lamp, and filled

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(*c*) *Rixdollar.*] A rix dollar is equal to 4 *s.* 6 *d.* A groſchen about 2 *d.*

with Wax: Some pour in firſt a ſolution of a certain Amalgam, and then fill up the ball with Wax: Others uſe Wax without Glaſs, and by certain additions communicate a Pearl colour on the outſide. This curious art is kept a ſecret in the hands of the workmen (*d*).

Chemical examination.

Powdered Pearl gives out nothing to water or to rectified ſpirit, by long digeſtion or coction. It diſſolves in the mineral acids, totally in the Vitriolic, and almoſt totally in the nitrous and marine, without communicating to them any perceptible tinge from the ſolution in the vitriolic acid, there ſeparates a cryſtalline matter, in appearance reſembling a Salt. It is not acted upon by Spirit of Sal ammoniac or cauſtic Ley: By plain alcaline Ley a little of the Pearl was corroded into a flaky ſubſtance.

Four drams of Pearl, diſtilled in a glaſs retort with an open fire gradually increaſed, gave over fourteen grains of an empyreumatic urinous liquor, of a volatile ſmell, with ſome footſteps of an empyreumatic Oil in the neck of the retort. The Caput mortuum was of an aſh-grey colour, and weighed three drams two ſcruples ſix grains: This being farther calcined in an open veſſel, then elixated with water, and the Lixivium filtered and evaporated, I obtained five grains of a fixed Salt, which appeared of a fine white colour, had a warm not very ſaline taſte, effervеſced with Oil of Vitriol, and during the effervеſcence diſcharged in vapour a little marine acid.

(*d*) *Artificial Pearls.*] The ingredient employed for giving the colour is a fine Silver-like ſubſtance found upon the under-ſide of the ſcales of the Blay or Bleak-fiſh The ſcales taken off in the uſual manner, are waſhed and rubbed with freſh parcels of fair water, and the ſeveral liquors ſuffered to ſettle: The water being then poured off, the pearly matter remains at the bottom, of the conſiſtence of Oil, called by the French *Eſſence d'orient*. A little of this is dropt into a hollow bead of bluiſh Glaſs, and ſhaken about ſo as to line the internal ſurface; after which, the cavity is filled up with Wax, to give ſolidity and weight. By this means Pearls are imitated in ſuch perfection, as not to be diſtinguiſhable by the eye from the natural, or to be diſtinguiſhable only by their having fewer blemiſhes. See a Memoir on the ſubject by M. de Reaumur, in the *Mem. de l'Acad. Royale de Sciences* (*de Paris*) *pour l'ann.* 1716.

PEARL. All theſe experiments were performed both upon oriental and occidental Pearls; and no difference could be obſerved betwixt the two, either in the quantity or quality of the products, excepting that the occidental Pearls yielded in diſtillation four grains more of liquor than the other, and that the Caput mortuum of courſe weighed four grains leſs.

II. BEZOARS. STONEY concretions are formed in many land animals; in the ſtomach of Goats, Harts, Horſes, Aſſes, Cows, *&c.* as well as in the urinary and gall-bladder of the human body (*e*). Several of theſe ſubſtances were by the credulity of former times celebrated as medicines of extraordinary virtue, and diſtinguiſhed by an oriental name BEZOAR, which is ſaid to ſignify a ſubduer of poiſons, or a lord over poiſons; hence *Bezoardic* is become a common appellation [in Germany, *&c.*] for all medicines ſuppoſed to be poſſeſſed of alexipharmac powers. The

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(*e*) *Humam Calculus.*] This concrete varies greatly in conſiſtence: Sometimes it is of a looſe texture, and almoſt friable betwixt the fingers; ſometimes very hard and compact, and capable of receiving a conſiderable poliſh. In either ſtate, particularly in the latter, it is difficult of ſolution even in the ſtrong mineral acids. The deſirable point, a menſtruum that ſhall diſſolve it and at the ſame time be innocent to the body, has hitherto been ſought for in vain.

There are, however, ſubſtances held to be inoffenſive, which though they do not make a perfect ſolution of the Calculus, are nevertheleſs found to ſoften and corrode it by degrees into a kind of mucous or powdery matter: and which, when freely taken into the ſtomach, have ſeemed to carry their virtues through the organs of digeſtion, and impregnate the urine with ſome degree of this lithontriptic power.

Such particularly are Lime-water and Sope; of which the former appears to be the moſt efficacious. According to Dr. Whytt's experiments, the power of Stone-lime-water is near one third greater than that of ſolutions of Sope in common water; and that of Oyſter and Cockle-ſhell Lime-waters, above double to that of Stone-lime-water. He finds that the activity of the Shell-lime-water alſo may be almoſt doubled, by pouring upon the calcined ſhells a ſtrong ſolution of Sope, inſtead of common water.

Alcaline Ley made cauſtic by Quick lime, and the cauſtic volatile ſpirits diſtilled with Quick-lime from Sal ammoniac or inſpiſſated urine, corrode the Calculus very plentifully. According to the author above-mentioned, the ſtrength of a cauſtic Ley, made from only an ounce of Pot-aſh and two ounces and a half of Quick-lime to a pound and a half of water, was about ſix times greater than that of Oyſter-ſhell Lime-water. The plain volatile ſpirits are far leſs active; and plain alcaline Ley, though loaded with the Salt, has ſcarce any effect at all upon the Calculus.

Be-

BEZOAR.

Bezoar of the Ape, and that of the Porcupine called *Piedra del porco* have been valued moſt: Single ſtones have been ſold for ſixty and eighty pounds ſterling.

There are two Bezoars kept in the ſhops, diſtinguiſhed from the countries whence they are brought, by the names of oriental and occidental.

ORIENTAL BEZOAR.

THE oriental or beſt Bezoar is found in the ſtomach of an animal, which is ſaid to bear a reſemblance both to the Goat and the Stag, to the former in the horns, beard, and tail; to the latter in the body, feet and hair; called by ſome *Cervicapra* and by others *Capricerva*, by Ray *Gazella indica cornubus rectis longiſſimis nigris prope caput tantum annulatis.* The animal is deſcribed and figured by Kæmpfer, in his *Amænitates*, and ſaid to be met with in different parts of Perſia, China, and the Eaſt Indies. Thoſe who feed upon mountains, on aromatic herbs, are ſuppoſed to afford a better Bezoar than thoſe on plains and vallies.

The Bezoar-ſtone is generally obſerved to be formed about ſome vegetable matter which the animal has ſwallowed, and which is often found in the middle of the ſtone upon breaking it; as a bit of ſtraw, wood ſtalk, or rind of plants, *&c.* This nucleus is gradually covered with ſucceſſive incruſtations one over another, which by conſtant motion in the ſtomach are rendered externally ſmooth and poliſhed. Such at leaſt is the common opinion of the production of Bezoar.

There are Bezoar ſtones of various figures, colours, and magnitudes; ſome round or oval, others long, flat, kidney-ſhaped: ſome compoſed of very thin, and others of thicker incruſtations; ſome greeniſh, verging more or leſs to yellow or blackiſh, others of a browniſh, greyiſh or blackiſh colour without any greenneſs. The largeſt are about the ſize of a ſmall Hen's egg: The emperor Rudolphus II. had a Bezoar-ſtone larger than a Gooſe-egg; but Boetius de Boot ſays it was white and light, and diſſolved eaſily upon the tongue; from whence it ap-

ORIENTAL BEZOAR.

pears plainly not to have been a natural ſtone but an artificial compoſition. The large compact, ſmooth, and ſhining ones, are preſerved as curioſities. For medicinal uſe, we muſt be ſatisfied with the ſmaller and coarſer; and even theſe are at preſent ſcarcely to be purchaſed for money.

The marks uſually laid down for judging of the genuineneſs of Bezoar, are, that it be of middling ſize, about that of a Pigeon's egg, compact, even, ſoft or ſmooth to the touch, of a ſhining ſurface, and a browniſh, greyiſh, or olive colour: That on ſucceſſively taking off the ſeveral incruſtations, the inner ones be all of poliſhed ſurfaces like the outer: That when reduced into powder, it appear of a fine green colour: That it have a cavity in the middle, without any vegetable or other matter encloſed: That a red-hot needle do not pierce into it: that it neither gain nor loſe any weight by ſoaking in warm water: That when the moiſt ſtone is rubbed upon dry Lime or on a wall white-waſhed with lime, or the dry ſtone rubbed upon moiſt Lime, it ſtain the Lime green; ſome make a purple, others a cheſnut-brown, and others a yellow ſtain, the mark of its genuineneſs: That in like manner it give a green ſtain to paper rubbed with Chalk: That it make a ſtrong efferveſcence with Spirit of Nitre, and tinge the menſtruum of a dark red colour: That it do not diſſolve in Spirit of Wine; and that it be neither very heavy nor very light. Theſe are all the characters of the true natural Bezoar, mentioned by authors, and it were eaſy to ſhew that they are all imitable by art.

The Indian writers, and many perſons of good credit, who have been in Perſia and the Indies, affirm, that the greater number of Bezoar-ſtones are no other than artificial compounds made there; that ſome prepare them from ſmall Bezoar ſtones reduced into fine powder and made up into a maſs; but that theſe are very rare, the common ones being made of different ingredients without any thing of the true Bezoar. Kæmpfer ſays, that the genuine Bezoar is in Perſia itſelf ſo rare and ſo dear, that he cannot believe that a ſingle ſtone comes into Europe. Many others agree in this account: and indeed the Bezoar-ſtone carries in itſelf ſtrong marks of art, but hardly any traces of its being formed by nature.

ORIENTAL BEZOAR.

It is principally in the urinary and gall-bladders, in the kidneys and in the ſtomach of animals, that Calculi are produced; it is very rare to meet with any in the inteſtines, the lungs or other parts. The ſtones of the kidneys and urinary bladder are commonly compoſed of different ſtrata, or incruſtations, often ſmooth and heavy like mineral ſtones, but oftener rough, ſpongy, light, and full of inequalities or protuberances: Chemically analyſed, or diſtilled in an open fire, they yield nearly the ſame principles as urine itſelf, or at leaſt an empyreumatic volatile urinous matter: They never have, and cannot have, any vegetable matter, graſs, pieces of roots, fruits, ſeeds, &c. for a nucleus——The gall-ſtones are commonly yellow, orange-coloured, green, of a blackiſh, greeniſh-brown, or a colour compoſed of green and yellow: They are often made up of incruſtations, ſeldom compact, but rather brittle and ſpongy and without any foreign matter within; In diſtillation, they yield the ſame principles as gall—The balls, or ſtones as they are called, formed in the ſtomach, conſiſt of ſuch matters as the animal has ſwallowed, hair, ſtraw, hay, herbs, roots, rinds, &c. imperfectly or not at all digeſted, and held together by the mucus or ſlimy juices of the part: Theſe rarely have any incruſtations; externally they are ſometimes ſmooth, and ſometimes not; they are uſually the lighteſt of all the calculous concretions, and of the ſtrongeſt ſmell, which in ſome is offenſive, and in others agreeable—When ſtones are found in the inteſtines, they generally contain ſome indigeſted matters, and ſmell of the place they were lodged in.

Now where could the Bezoar-ſtone have been formed; a ſtone compoſed of ſuch fine, equal, regular, poliſhed incruſtations, with a cavity or extraneous body in the middle? it cannot be produced in

parts

ORIENTAL BEZOAR.

parts where thoſe bodies do not enter, becauſe they are oftentimes actually found in it: It cannot be produced in thoſe parts where they do enter, becauſe then they would be intermixed through its whole ſubſtance as in the balls found in the ſtomach. How uniform are all the ſtrata in one Bezoar-ſtone! How equal throughout in hardneſs, brightneſs and politure! and yet how different are different ſtones in all theſe reſpects from one another! Such a regularly formed concrete is not ſurely the reſult of a fortuitous accumulation and induration of matter tumbling in the paunch of an animal.

Oriental Bezoar-ſtones, chemically conſidered, may be divided into two claſſes; thoſe which are ſuppoſed to be genuine, and thoſe which are acknowledged to be counterfeit. The firſt are compounded of Plaſter-of-Paris, Chalk or other earths, impregnated with a vegetable green tincture: The latter are made chiefly of reſinous ſubſtances, diſtinguiſhable by their liquefying in the fire, and diſſolving in Spirit of Wine. I have examined ſeveral of both ſorts, but never could diſcover any mark of an animal nature; though an animal ſubſtance, where or whatſoever it be, cannot eſcape diſcovery in a chemical enquiry. If ſome ſtones, however, ſhould give out an urinous empyreumatic matter in the fire, it would not follow that they are natural productions, as an animal Glue may be uſed, and according to ſome accounts often is uſed for the conglutinating ingredient.

We may add to the foregoing a third claſs of Bezoars, made up with gums, with extracts, or with inſpiſſated juices: Theſe are very rare; they are diſtinguiſhed by their diſſolving in great part in water. I have ſeen and taſted ſome of this kind at Frankfort upon the Maine and at Leghorn, but could not procure any for examination.

A fine, choice oriental Bezoar-ſtone, of the genuine kind (that is, of thoſe compounded of earths) being reduced into fine powder, and a ſcruple of the powder digeſted in a glaſs body with a ſuitable quantity of rectified Spirit of Wine, the ſpirit acquired a

ORIENTAL BEZOAR.

greeniſh-yellow colour, and on being evaporated, left behind a minute portion, ſcarce amounting to one grain, of a blackiſh extract, of no remarkable ſmell or taſte.

On boiling another ſcruple of the powder in diſtilled water, the event was the ſame: the water acquired a green tinge, and left on evaporation, ſcarcely one grain of an extract ſimilar to the former. The powder remaining after the action of both liquors appeared unaltered.

A ſcruple of the counterfeit reſinous Bezoar digeſted in rectified ſpirit, yielded ſeventeen grains of extract, only three grains remaining undiſſolved: The extract was of a yellowiſh green colour, reſinous, ſtuck to the teeth, taſted bitteriſh, and ſmelt diſagreeably.

With water I could ſcarcely get half a grain of extract from a ſcruple of this kind of Bezoar, though the powder was long digeſted and boiled in the liquor: The extract had a bitteriſh taſte, without any ſmell: The reſiduum was in ſmell, taſte, and colour unaltered.

The powder of the earthy Bezoar, was not acted on by Spirit of Vitriol. To Spirit of Nitre, it inſtantly communicated a red colour, and raiſed an efferveſcence: The liquor continued of a dark red ſo long as it was kept in the cold, but on applying heat, it preſently became of a bright yellow, and diſſolved all the bezoar, excepting a very ſmall quantity of flaky matter. Spirit of Salt acquired a fine yellow colour, and the undiſſolved powder appeared of a greeniſh yellow. Spirit of Sal ammoniac extracted a browniſh yellow tincture, and left the powder reddiſh at top, and aſh-coloured underneath. Alcaline Ley was tinged of a bright brown; the powder unaltered: Cauſtic Ley, of a dark reddiſh-brown; the powder of a Sulphur yellow.

The reſinous Bezoar ſwam upon Spirit of Vitriol, like other reſinous bodies, and was not ſenſibly acted on. About one half of it diſſolved in Spirit of Nitre, and tinged the liquor yellowiſh, the reſt melting together and ſwimming on the ſurface. Spirit of

ORIENTAL BEZOAR.

Salt received no colour; as ſoon as it was poured on, the powder melted all into one maſs and roſe to the top. In Spirit of Sal ammoniac, it fell to the bottom, unacted on. In alcaline ley, it floated, and appeared curdly like Sope; the liquor looked yellowiſh. Cauſtic Ley diſſolved greateſt part of it, and became in like manner ſopy, and thick like Mucilage.

Two drams of the earthy Bezoar were diſtilled in a glaſs retort, in a well graduated open fire. So long as the heat was continued gentle, the powdered ſtone retained its original colour, and the liquid which came over proved colourleſs as water. As the heat was increaſed the drops grew yellowiſh, and at laſt of a deep yellow; the powder at the ſame time acquiring a Sulphur yellow colour on the ſurface; a little Sublimate of the ſame colour ariſing into the neck of the retort; There now appeared at the bottom, at one ſide, where perhaps the heat was greateſt, a conſiderable lump of curious ſaline ſpicula, exactly reſembling flowers of Benzoine. When the matter became red hot, a ſmoky vapour aroſe, which changed the upper part of the yellow Sublimate to a ſooty blackneſs. The diſtilled liquor amounted in all to three ſcruples and a half; it had an empyreumatic ſmell and taſte, like Spirit of Tartar, without any thing of the volatile urinous ſmell produced from animal ſubſtances. The yellowiſh Sublimate weighed three grains, ſmelt like old ſmoky tobacco-pipes, and taſted ſomewhat ſaline. The ſooty Sublimate weighed but one grain; it was partly ſhining, very light, of no ſmell or taſte. The Caput mortuum weighed two ſcruples ſix grains, was very black, light, and had not melted or run together.

Two drams of the reſinous Bezoar being treated in the ſame manner, the powder flowed thin in a gentle heat, like Wax or Reſin. On increaſing the fire there aroſe a ſcruple of yellowiſh empyreumatic liquor, and afterwards a dram and thirty-two grains of a blackiſh-brown empyreumatic Oil, in ſmell exactly reſembling the fetid Oils obtained from other Reſins. In the bottom of the retort there remained but eight grains of a black, ſpongy, friable coal.

OCCIDENTAL BEZOAR.

THE occidental Bezoar is ſaid to be found in the ſtomach of an animal of the ſame genus with that which affords the oriental. This ſort of Bezoar is not near ſo beautiful, ſo ſmooth, or ſo poliſhed as the other: It is commonly of a whitiſh, aſh, or dark-grey colour; ſometimes browniſh or blackiſh; and ſometimes of a greeniſh-yellow.

A ſcruple of occidental Bezoar, digeſted with rectified Spirit of Wine, gave only half a grain of extract, of a yellowiſh-green colour, a ſomewhat rancid taſte, and no ſmell: The remaining powder appeared unaltered. Diſtilled water extracted alſo but half a grain from a ſcruple: This extract was of a greeniſh-brown colour, and had neither taſte nor ſmell.

Spirit of Nitre and Spirit of Sea-ſalt diſſolved greateſt part of the Bezoar, and Spirit of Vitriol the whole: All the ſolutions were yellowiſh: From that made in the vitriolic acid, a little cryſtalline matter ſeparated.

Spirit of Sal ammoniac, common alcaline Ley and cauſtic Ley did not diſſolve any ſenſible quantity of the powder, but acquired from it a yellowiſh tinge; the cauſtic Ley gained the deepeſt yellow.

On diſtilling two drams in an open fire, there aroſe twenty-two grains of a browniſh-yellow liquor, of an empyreumatic and ſomewhat volatile ſmell; on the ſurface of which ſwam two little drops of an empyreumatic Oil: The Caput mortuum weighed one dram and thirty eight grains; it was quite black, and continued a ſubtile powder like the Bezoar employed.

From theſe experiments it appears, that the occidental Bezoar is more likely to be an animal production than the oriental, as it yields in diſtillation ſome ſmall portion of volatile urinous matter. It is nevertheleſs much inferior in value, as being leſs beautiful, and ſcarcely ever made uſe of in medicine. If the oriental and occidental Bezoars were both genuine, or

OCCIDENTAL BEZOAR. true animal calculi, they would probably be equal in virtue to one another, though aſſuredly not equal to Oyſter-ſhells and other common abſorbents.

III. OCCULI CANCROR. CRABS-EYES, improperly ſo called, are neither eyes, nor the produce of the Crab; but Calculi found in the ſtomach of the Craw-fiſh or *Aſtacus fluviatilis.*

The Craw-fiſh caſts its ſhell every year, and it is only during the little time that the new ſhell continues ſoft, that the animal can increaſe in bulk: As the ſhell hardens and confines the fiſh, a white nutritious juice, ſecreted in two portions of the ſtomach, forms by degrees a ſoft calculous ſubſtance, of a cruſtaceous texture from ſucceſſive appoſitions of the juice. Before the caſting of the ſhell, the ſtunted animal grows weak and ſick, and for ſome days lies almoſt dead: It does not take food till ſome days after, and, in this period, the Calculi ſeem to ſerve for its aliment. Hence we meet with Crabs-eyes (for ſo we muſt call them in compliance with cuſtom) both in young and in old Crabs before they loſe their ſhells, and for a few days afterwards, and not in one or the other for a conſiderable time after that period.

Crabs-eyes are of different ſizes, hemiſpherical or convex on one ſide, flat or concave on the other, of a bluiſh, white or reddiſh-white colour, of a leafy ſtructure, moderately firm and compact: There are ſmall ſtriæ upon the convex part, and irregular impreſſions in the concavity.

Some prefer the blue ſtones, taken from the live fiſh, on a ridiculous principle, that they are impregnated with the animal ſpirits, which by boiling are diſſipated. Thus much however it is proper to obſerve, that the blue colour is deſtroyed by boiling the fiſh, and that ſalt water inclines it more to reddiſh than freſh water. They loſe their blueneſs alſo by long keeping. When the bluiſh tinge is ſo pale as not to be diſtinguiſhed in the dry ſtone, it becomes perceptible on pouring hot water upon them; when long kept, they exhibit no blueneſs either moiſt or dry.

Crabs-

Crabs-eyes have been often counterfeited with artificial compoſitions of different earths, particularly Chalk, Plaſter-of-Paris and tobacco-pipe Clay, formed in moulds. Theſe are commonly whiter and lighter than the genuine, imbibe more water, adhere more ſtrongly to the tongue, and have leſs diverſity of figures or characters in the concave part. But the more certain criteria are, that they want the leafy texture of the genuine, and are affected in a different manner by acids. A counterfeit Crabs-eye, put into diluted Aqua fortis, diſſolves either wholly or by piecemeal, or not at all, whilſt the genuine, though great part of it is diſſolved, retains its figure, its earthy baſis being extracted by the acid, and the gelatinous conglutinating matter left entire, but porous like a ſponge.

OCCULI CANCROR.

This experiment does not ſucceed with undiluted Aqua fortis; for the concentrated acid, acting more violently on the ſtone, whilſt it diſſolves the earthy matter, divides and diſunites the gelatinous, of which we can now diſtinguiſh only a few flakes.

The nitrous acid diſſolves a larger quantity of Crabs-eyes than any of the others: An ounce of good Spirit of Nitre takes up four drams; the ſame quantity of Spirit of Salt, only three drams, The vitriolic acid, whether concentrated or diluted, diſſolves exceeding little; an ounce either of the Spirit or Oil of Vitriol extracting but five or ſix grains. The mild vegetable acids, Vinegar, Lemon-juice, &c. take up about as much. Neither water nor rectified ſpirit extract any thing at all.

Sixteen ounces of Crabs-eyes, diſtilled in an open fire, give over three ounces and a half of liquor, ſlightly urinous and empyreumatic: The remaining coal, burnt to white aſhes, yields on being elixated with water a ſcruple of fixed Salt.

IV. CUTTLE BONE.

THE CUTTLE-BONE, ſo called, has nothing of the hardneſs or texture of bones: It is a white brittle ſubſtance, ſo light and fungous that the Dutch call it *Zee ſchuym*, Sea-ſcum. It is produced on the back of

CUTTLE-BONE. the Cuttle-fiſh, and has on its upper ſurface a cruſt, harder and more compact than the reſt.

The Cuttle-fiſh, *Sepia*, is met with chiefly in the Mediterranean ſea, near the ſhores: The bone is often thrown on ſhore by ſtorms, and there picked up; I have ſeen ſeveral along the coaſt of the Adriatic, in travelling from Loretto by the way of Ancona, Peſaro Rimini, *&c.* This fiſh is one of thoſe, whoſe fleſh lies bare, without any ſkin; the others of that claſs are, the *Polypus* and *Loligo.* It is furniſhed with a certain liquor of an inky blackneſs, which it is ſaid to throw out upon being purſued, and thus to eſcape or conceal itſelf by rendering the water muddy. This liquor, inſpiſſated, is ſaid to be the principal ingredient in the Indian ink uſed in drawing,

Half an ounce of the ſoft ſpongy part of Cuttle-bone, digeſted in rectified Spirit of Wine, gave ſix grains of extract, of a fiſhy ſmell, a ſaline taſte and cryſtalline appearance. Another half ounce, digeſted and boiled with water, gave a ſcruple of extract, in colour whitiſh-brown, in taſte quite ſaline. The powder remaining after the action of both liquors appeared unaltered.

The powdered bone, ſprinkled by little and little into Spirit of Vitriol, totally diſſolved, and ſoon cryſtallized again upon the ſurface, without communicating any tinge to the liquor. The nitrous and marine acids likewiſe totally diſſolved it, without receiving any colour. The ſolution in the marine acid was in taſte extremely bitter: This acid forms indeed a bitter compound with all the animal and other abſorbent earths; but with none ſuch an intenſe bitterneſs as with Cuttle-bone. Spirit of Sal ammoniac had no effect upon this bone. Common alcaline Ley and cauſtic Ley corroded a little; the firſt acquired no tincture, the latter a yellowiſh one.

Two ounces of the powder, diſtilled in a glaſs retort in an open fire, gave over two drams of an urinous liquor, of a ſlightly volatile ſmell mixed with the common empyreumatic one; on its ſurface there was alſo

also a little actual empyreumatic Oil. The Caput mortuum weighed one ounce ſix drams.

CUTTLE-BONE.

I repeated the ſame experiments upon the upper hard cruſt or ſhell. Half an ounce of this yielded with rectified ſpirit four grains, and with water a ſcruple of extract: Both the extracts agreed exactly with thoſe made from the ſpongy part, except that the watery extract of the ſhell was of a darker brown colour: Both the reſidua were unchanged.

The powdered ſhell totally diſſolved in Spirit of Vitriol, tinged the menſtruum reddiſh, and ſeparated again in part in a fine white cryſtalline form. It totally diſſolved alſo in Spirit of Nitre and Spirit of Sea-ſalt, without imparting any colour. By Spirit of Sal ammoniac, it was not ſenſibly acted on. Common alcaline Ley corroded a little into flakes, without acquiring any tinge: Cauſtic Ley received from it a yellowiſh hue, but diſcovered no further action.

On diſtilling two ounces in an open fire, I obtained four ſcruples of urinous liquor, of a volatile empyreumatic ſmell, and half a ſcruple of empyreumatic Oil; the Caput mortuum weighed one ounce ſix drams and a half.

It appears from this analyſis, that the difference betwixt the two ſubſtances, in regard to the principles they are compoſed of, is not very great: That the ſhell contains moſt oily matter, and conſequently that the ſpongy part is the pureſt earth and the ſtrongeſt abſorbent.

This earth is ſuppoſed to differ, medicinally, from the other animal abſorbents, in having a mild aſtringency. It is ſometimes uſed by thoſe who caſt metals in the ſmall way, for forming a mould.

CLASS II.

Earthy parts of Animals reducible by Fire into Quick-Lime.

CALCAREOUS.

THIS claſs comprehends the ſhells of ſea-fiſhes; a ſubject which, by the multiplicity and diverſity

CALCAREOUS. ſity of colours and figures, is both extenſive and delightful to the naturaliſt, but affords little variety to the chemiſt. All theſe ſubſtances conſiſt of the ſame calcareous earth, blended with more or leſs of the conglutinating animal principles. They burn into a Quick-lime, more acrimonious, which impregnates water with a greater degree of activity, and which, when tempered into mortar, proves more durable and more compact than the Limes made from mineral ſtones or earths (f). The Dutch have no other Lime for building, than calcined ſea-ſhells, particularly thoſe of Muſcles.

I. MUSCLE SHELLS. HALF an ounce of MUSCLE-SHELLS digeſted and boiled in rectified Spirit of Wine, yielded one grain of extract, which taſted and ſmelt rancid. Another half ounce, treated with water, gave a ſcruple of a yellowiſh maſs, in taſte ſaline. The remaining powders had the ſame appearance as at firſt.

This ſhell totally diſſolved in Spirit of Vitriol, tinged it a little yellowiſh, and in great part ſeparated again from the ſolution in a white cryſtalline form. It diſſolved totally alſo in Spirit of Nitre, and almoſt totally in Spirit of Salt, without giving any colour to either: The ſmall matter that was left by the marine ſpirit, on being ſhaken up, rendered the liquor white, yellow and orange-coloured. Spirit of Sal ammoniac has no effect. Common Ley eats off a little flaky matter, and acquires a yellowiſh tinge: Cauſtic Ley becomes alſo yellowiſh, and renders the powder blackiſh

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(f) *Shell lime ſtronger than Stone-lime-water.*] We have formerly ſeen that Oyſter ſhell Lime-water acts much more powerfully on the human calculus than that of Stone lime: Dr. Home informs us from experiment, that it is likewiſe the moſt efficacious in the bleaching of linen; that it whitens more, weakens more, and extracts more out of the cloth; that it ought to be looked upon as the moſt expeditious, but at the ſame time the moſt dangerous material for bleaching, that is yet known.

His experiments on this ſubject afforded one remarkable phænomenon——Lime and Lime-water preſerve many animal ſubſtances in a ſound entire ſtate: but Lime and alcalies mixed together, yield a Ley which, in regard to animals, is extremely corroſive. The effects of theſe ſubſtances on linen are juſt the reverſe; Lime-water being here highly corroſive, and alcalies weakening its power in proportion to their quantity, inſomuch that he judges a mixture of one part of Lime with four of pure Alcali might be uſed in bleaching with ſafety.

iſh underneath, and of a fine hoary whiteneſs on the upper ſurface. MUSCLE SHELLS.

From two ounces, diſtilled in a retort, were obtained two ſcruples of liquor, of a conſiderably volatile empyreumatic ſmell, with ſome drops of actual Oil ſwimming upon it: The Caput mortuum weighed one ounce ſeven drams and a ſcruple.

Calcined Muſcle-ſhells, conſidered as a Lime, bind ſtrongly and quick. A certain phyſician preſcribed, in his Majeſty's Apotheca, a draught compoſed of calcined Muſcle-ſhells, vitriolated Tartar, Syrup of Citron-juice, decoction of Hartſhorn, and ſome ſimple waters. Accordingly the burnt ſhells and vitriolated Tartar were well rubbed together, the Syrup mixed with them, and the decoction and waters added by degrees: But inſtead of forming a liquid mixture, the powder, ſo ſoon as it was moiſtened, concreted into a maſs of a ſtony hardneſs, which required violence to get it out of the mortar.

II. OYSTER SHELLS.

OYSTER-SHELLS contain leſs oily matter than thoſe of Muſcles. Hoffmann reports, that neither one nor the other diſcover in diſtillation any mark of Oil at all; but the firſt yield an actual Oil, and the latter ſufficient marks of one. From two ounces of Oyſter ſhells, cleaned from the outer rough part, there aroſe half a dram of liquor, of a ſlightly volatile and empyreumatic ſmell; and in the neck of the retort there appeared ſome fine oily and ſaline ſtriæ. If the quantity of ſhells employed, both in Hoffman's experiment and mine had been larger, we ſhould probably have had a more viſible proof that they are not deſtitute of Oil. The Caput mortuum was of a ſooty black colour, and weighed one ounce ſeven drams and a half.

Half an ounce of powdered Oyſter-ſhells yielded, with rectified ſpirit, one grain of extract, of a rancid taſte and ſmell. From the ſame quantity were obtained by water twenty-five grains of a yellowiſh maſs, to the taſte quite ſaline. The remaining powders were in appearance unaltered.

OYSTER SHELLS.

The powdered ſhell diſſolved totally in all the mineral acids; and communicated no colour to any of them; from the ſolution made in the vitriolic acid, there ſeparated a fine white cryſtalline matter. Alcaline liquors had no effect, excepting that alcaline Ley ſeemed to corrode a little of the powder, as it rendered it ſomewhat flaky.

III. MOTHER of PEALR.

THE oriental PEARL-FISH has a great affinity with the common Oyſter; being a flattiſh bivalvous ſhell fiſh, rough on the outſide, generally about the ſame ſize, though ſome are much larger, and continuing fixed upon the ſpot where it is formed. It is flatter than the Oyſter, and the internal part of the ſhell of a fine Pearl colour, with a reddiſh or greeniſh caſt, or more or leſs of a rainbow appearance. The lower ſomewhat concave ſhell is more beautiful than the upper flat one; and hence the former is that brought into Europe, for ornamental uſes, under the name of Mother-of-Pearl, *Mater Perlarum*. Both this and the common Oyſter-ſhell are compoſed of ſtrata laid regularly on one another; a new incruſtation being formed every year on the inſide of the ſhell. It ſeems to be one and the ſame juice, which regularly ſecreted forms the ſhell, and which unequally diſtributed or ſtagnating in particular parts concretes into Pearls; notwithſtanding the chemical differences obſerved in the two concretes.

Half an ounce of Mother-of-Pearl, reduced into powder, yielded with rectified Spirit one grain of extract, of a fiſhy ſmell, and ſaline taſte. The ſame quantity, treated with water, yielded a ſcruple of extract, in colour yellowiſh-brown, in taſte quite ſaline. The powders, remaining after the action of both menſtrua, were of the ſame appearance as at firſt.

Saline liquors had the ſame action on Mother-of-Pearl as on other ſhells. All the mineral acids diſſolved it, without receiving any tinge, except that the marine acid left a ſmall portion undiſſolved, which when ſhaken up into the liquor, appeared compoſed of white, yellowiſh and reddiſh particles floating diſtinct from one another. Spirit of Sal ammoniac and cauſtic Ley had no effect: Plain alcaline Ley corroded a little into flakes, but acquired no colour.

MOTHER-of PEARL.

Two ounces of powdered Mother-of-Pearl being diſtilled in a glaſs retort in an open fire gradually increaſed, there came over two ſcruples of an urinous liquor; which ſmelt a little volatile and empyreumatic: On its ſurface were obſerved ſome drops of an empyreumatic Oil. The Caput mortuum weighed one ounce ſeven drams and a ſcruple.

Dr. ——— reports, that if this ſhell be laid in whites of eggs well beat up, and ſet in the ſun or in a warm place, and this proceſs ſeveral times repeated, the ſhell will become ſoft enough to receive impreſſions; and that it recovers its hardneſs on being laid in water wherein Tartar has been ſeveral times boiled. I have tried the experiment, without being able to ſucceed. Perhaps the author has delivered it without having made trial himſelf, or perhaps he has concealed ſome particular management that may be neceſſary to the ſucceſs.

IV. CRABS-CLAWS.

THE BLACK TIPS of the claws of the common ſea CRAB, *Cancer marinus*, levigated into a ſubtile powder, are frequently employed in medicine as an abſorbent. Half an ounce of this powder yielded with rectified ſpirit two grains of extract, of a black colour and ſaline taſte: With water, the ſame quantity yielded ten grains, in colour browniſh, in taſte very ſaline: Both the reſidua appeared unaltered.

Spirit of Vitriol diſſolved a conſiderable quantity, and cryſtallized as with the other animal earths: Spirit of Nitre and of Sea-ſalt diſſolved nearly the whole; and like that of Vitriol, received no colour. Spirit of Sal ammoniac diſſolved a little, without acquiring any tinge: Common and cauſtic Ley were tinged yellow, without diſcovering any remarkble ſolution.

Four ounces of the powder, diſtilled in an open fire, gave over half an ounce of liquor, of an empyreumatic and ſlightly volatile ſmell, with ſome drops of an empyreumatic Oil upon the ſurface: During the diſtillation, there was an appearance of an actual volatile Salt, but in the progreſs of the operation it was diſſolved and waſhed down by the liquor. The black Caput mortuum weighed three ounces and a half.

V. EGG-SHELLS. TO this claſs may be referred the SHELLS OF HENS EGGS, and perhaps thoſe of the eggs of other birds. Half an ounce of the Shells of Hens-eggs, cleared from the inner ſkin and reduced into powder, yielded with rectified Spirit of Wine, a grain and a half of ſolid extract, which in taſte and ſmell was quite rancid. From the ſame quantity I obtained, by means of water, twenty grains: This extract appeared of a yellowiſh colour, and what is pretty remarkable, proved ſaline to the taſte. The remaining powders had the ſame appearance as at firſt.

Among acids, Spirit of Nitre acts upon Egg-ſhells the moſt powerfully and moſt readily. An Egg, laid in Spirit of Nitre, had its ſhell entirely eaten off in two hours, the liquor continuing clear. Spirit of Salt likewiſe diſſolves nearly the whole of the ſhell, but requires ſix or eight hours: The ſolution is colourleſs, and of a bitter taſte, which thoſe made in other acids are not. Spirit of Vitriol corrodes, difficultly, nearly all the ſhell, and forms with it, as with the other animal earths, fine cryſtalline concretions of a ſaline appearance, without receiving any tinge.

Vinegar diſtilled and undiſtilled, diſſolves the whole in about twelve hours; the ſolution is ſomewhat ſlimy and glutinous. The action of the acid may be promoted by cautiouſly taking out the Egg from time to time, and ſcraping off the ſlimy corroded matter with a fine knife. Towards the end of the proceſs, the Egg ſeems to expand, as if air, or a part of the menſtruum had penetrated through the pores of the ſkin; or perhaps from the included air dilating itſelf, on the removal of the ſolid matter which held it in confinement. The Egg thus freed from its ſhell is conſiderably ſoft, but does not admit of its figure being much altered, much leſs of being rolled out ſo ſlender as to enter a narrow-mouthed bottle, as reported in books of ſecrets: Laid in water, it becomes a little harder, but is very far from reſuming the hardneſs of the ſhell which it has loſt.

EGG-SHELLS.

Solution of Tartar, which diſſolves, like other acids, ſundry abſorbent earths, had no effect on the ſhell of an Egg, though digeſted with a heat gradually raiſed to ebullition. Nor did alcaline liquors, as Spirit of Sal ammoniac, common Ley and cauſtic Ley, ſeem to have the leaſt action on it, except that the common Ley eat off a little flaky matter.

On diſtilling two ounces of powdered Egg-ſhells, in a glaſs retort in an open fire, I obtained two ſcruples and a half of urinous liquor, which had a volatile empyreumatic ſmell, with ſeveral drops of empyreumatic Oil upon the ſurface; after this aroſe ten grains of volatile Salt, and one ounce ſeven drams of black coal remained behind in the retort. Hoffmann in his *Obſervationes phyſico-chemicæ*, and Boecler in his *Materia medica*, report, that Egg-ſhells yield an uncommonly large quantity of volatile Salt; but ten grains upon two ounces is very far from being a large yield.

Egg-ſhells are employed by the wine-coopers for curing Wines upon the fret: Added in a ſuitable ſmall quantity, they obtund the acidity, and render the liquor fit for drinking, and ſufficiently wholſome: An over-proportion occaſions the Wine to grow in a very little time vapid, by abſorbing not only the preternatural acid, but that which is eſſential to it as a vinous liquor. For medicinal uſe, ſome previouſly calcine the ſhell: In this ſtate, it is more acrid and aſtringent than before, and imbibes water more readily and with ſome degree of ebullition. Various images and figures are formed of this calx mixed up with ſtrong Glue.

THE marine productions, Coral, Coralline, and Sponge, uſually ranked among vegetables, differ greatly in their chemical analyſis from land-plants and their parts, and agree with ſubſtances of the animal kingdom (*g*). Their prevailing principle is an

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(*g*) *Agree with animal ſubſtances.*] Some late obſervations afford reaſon to believe, that theſe bodies are really animal productions; the work and the habitation of marine polypi. See the late volumes of the Philoſophical Tranſactions, and a paper by Mr. Juſſieu in the French Memoirs for the year 1742.

earth; but to what claſs this earth belongs, has not hitherto been determined.

1. CORAL. CORAL, (*Corallum, coralium, quaſi* κόρη ἁλὸς, daughter of the ſea) is a hard ſtony ſubſtance, reſembling in figure the ſtem of a plant, divided into branches. It is of different colours, black, white, and red: The red is the ſort emphatically called Coral, as being the moſt common, and moſt valuable, and employed in the way of ornament; it is of a fine uniform red colour throughout its whole ſubſtance.

The greateſt quantities of Coral are met with in the Mediterranean ſea, as on the coaſts of Tuſcany, Sicily, Sardinia, Catalonia, Corſica, Majorca, Minorca, *&c.* It is fiſhed for by means of a large wooden croſs, furniſhed with a weight of Lead in the middle to ſink it, and with net work between the arms, which being drawn by ropes, backwards and forwards among the rocks, entangles the Coral: Oftentimes divers are let down, to direct the ends of the arms into cavities of the rocks.

The Coral is produced upon the rock, and on different extraneous bodies in the ſea, and hangs with its branches downwards. It has no appearance of any root like vegetables; and adheres only ſuperficially, to the body on which it is formed, by a baſis which has the exact impreſſion of the part which it adheres to; a mark of its having been, at its firſt formation, in a ſoft ſtate.

When Coral is newly taken up, the ſmall protuberances on its ſurface are ſoft, and yield, on being preſſed, a milky juice, which efferveſces with Spirit of Salt and with Spirit of Nitre, but not with any Alcali.

Count Marſigli has made ſome curious obſervations on this ſubject. Branches of freſh Coral being put into a veſſel of ſea-water, the protuberances, after ſtanding for ſome time, opened; and there came forth from each a fine white body, in form of a ſtar with eight rays: On taking the ſprigs out of the water, theſe white bodies immediately ſhrunk in again, and in their place appeared red protuberances as at firſt;

CORAL.

firſt: On putting the Coral ſprigs a ſecond time in water, the protuberances opened again, and the white flowers, as he ſuppoſes them, [but more probably animalcules of the polypus kind] came forth as before. After theſe bodies had kept expanded in the water for ſome days, they contracted into yellow balls, which dropt off and fell to the bottom, and on being opened were found to contain only a glutinous matter, not any fruit or ſeed as was expected. The cortical part of the Coral had now grown ſoft, and fell off in pieces, which formed a ſoft earth like fine Redbole. At the ſame time, a milky juice, lodged betwixt the cortical part and the inner ſubſtance of the Coral, was communicated to the water, and made it putrefy; but in leſs than a month, there appeared upon the ſurface a white gelatinous ſkin, about the thickneſs of the back of a knife, and the water recovered its original ſmell and taſte.

The cortical part which the Coral is all over coated with, is not near ſo compact and hard as the internal, and may be eaſily taken off whilſt freſh: The coral is commonly freed from this bark before it is brought to market. The greateſt coral trade is in Genoa and Leghorn. The ſmall ſprigs, unfit for ornamental uſes, are in the ſhops levigated into a ſubtile powder, which is given medicinally as an abſorbent and mild reſtringent.

Coral is not unfrequently imitated by artificial compoſitions; ſome of which exactly reſemble the natural in weight, hardneſs, politure, colour and appearance, are equally reduced, by ſhaving with a knife into a fleſh-coloured powder, make the ſame grating noiſe betwixt the teeth, equally efferveſce with Spirit of Nitre, and yield a like yellowiſh magma. The abuſe is beſt diſcovered by fire, the counterfeit not affording the alcaline earth which the genuine Coral does. The colouring ingredients in the artificial maſſes are Cinnabar and Minium, both which are eaſy to be diſcovered.

The natural Coral ſeems to receive its colour from Iron; for Spirit of Vitriol acquires from it a ferrugineous

CORAL.

neous taſte ; and on calcining the Coral, ſome ferrugineous particles are attracted by the magnet from among the aſhes.

Sixteen ounces of Coral, diſtilled in an open fire, yield commonly about ſix ſcruples and a half of a volatile urinous liquor impregnated with volatile alcaline Salt and Oil, together with two or three grains of an actual empyreumatic Oil : From the Caput mortuum, calcined, five ſcruples and a half of fixed Salt may be extracted. The quantities of theſe products vary, according as the Coral is freſher or longer-kept: Once I obtained, from Sixteen ounces, three drams of urinons ſpirit, and three drams of fixed Salt; another time I got ſcarce two ſcruples and a half of ſpirit, and no Oil, the proportion of fixed Salt being nearly the ſame as before.

The fine red colour of Coral moved the credulity of former times to expect from its extraordinary medicinal virtues; and accordingly various ſolutions, magiſteries, Salts, and other preparations have been made from it in this view. The principal aim has been, to extract its colouring matter in the form of ſpiritous tincture: Red tinctures have indeed been prepared with it, but they owed their colour to the menſtruum or to other ingredients ; the colour of the liquor turning out the ſame, when white Coral is uſed as when the red, and even when no Coral is uſed at all.

It is obſervable however that in ſome of theſe proceſſes the coral loſes its colour. One of the tinctures is prepared by diſſolving a pound of Sugar in a little water, adding half a pound of Wax, boiling a pound of Coral in this mixture till it loſes its redneſs, and then digeſting the Wax and Sugar in Spirit of Wine. The Coral, deprived of its colour by this proceſs, is found to be in other reſpects unaltered, and to have loſt nothing of its weight. I have not been able to reſtore its colour, by baking it in a loaf of bread, hanging it in a privy, or the other means recommended by authors for recovering and calling forth its latent redneſs.

Le-

CORAL.

Lemery relates, that by treating red Coral with white Wax, and afterwards digeſting the Wax with tartarized Spirit of Wine, he has transferred the tincture of the Coral out of the Wax into the Spirit. On repeating this experiment, I obtained no tincture, but only a quite thick ſolution of the Wax, though trial was made with both kinds of tartarized Spirit of Wine, that prepared by ſolution, and that by diſtillation.

Among all the tinctures of Coral, Langelott's (deſcribed in the *Ephemerides naturæ curioſorum*) is the moſt remarkable, though it is at the ſame time not a little ſuſpicious. Pieces of red Coral, digeſted for a month with a perfectly white diſtilled Oil, are ſaid to have become redder and ſofter: and on continuing the heat, to have been reſolved into a deep red Mucilage (*Mucilago rubicundiſſima*); the Oil remaining colourleſs, and not miſcible with the Mucilage. This Mucilage, ſeparated from the Oil, and digeſted a little in tartarized Spirit of Wine, is ſaid to have been reſolved into a deep red tincture.

II. CORALLINE.

CORALLINE, *Corallina*, (ſo called from its having been firſt obſerved upon Coral) is a branched ſubſtance, reſembling ſome of the moſſes, compoſed of a number of articulations, found adhering to different bodies, in the Mediterranean and other ſeas. It is of various colours, reddiſh, yellowiſh, green, greeniſh and whitiſh; among which the green and whitiſh are the moſt common. It is friable betwixt the fingers, gritty like ſand betwixt the teeth, of a ſomewhat ſaline taſte, and a ſtrong fiſhy ſmell. Phyſicians ſuppoſe it to be anthelmintic.

Half an ounce of powdered Coralline, boiled with water, gave two ſcruples of extract: and afterwards with rectified ſpirit, ten grains: Spirit, applied at firſt, extracted from the ſame quantity thirty grains; and water, afterwards, juſt as much: The earthy reſiduum weighed, in the firſt caſe three drams ten grains, in the latter only three drams. Spirit of Nitre diſſolved a conſiderable portion of the Coralline. On diſtillation in an open fire, there aroſe an urinous and empyreumatic liquor.

III. SPONGE. SPONGE is a ſoft, tough, compreſſible, ſubſtance full of pores, found, like the two foregoing, adhering to different bodies in the ſea. It is of various ſizes and colours, yellowiſh-white, yellow, reddiſh-yellow, brown, greyiſh, *&c.* The middling pieces, of a yellowiſh colour, with ſmall pores, free from ſtones, ſhells, *&c.* are the beſt.

The great compreſſibility of Sponge, and its property of ſoaking up water, makes it uſeful, mechanically on many occaſions. From the ſame property it is ſometimes employed by the ſurgeons for dilating the orifices of wounds and ulcers: A piece of Sponge, dipt in melted Wax, may be preſſed into a very little compaſs, and is prevented from expanding again by the induration of the Wax; a piece thus prepared, put into the orifice, imbibes the moiſture of the part, and is proportionably dilated.

Burnt Sponge is ſometimes employed in powders for cleaning the teeth, and likewiſe given by phyſicians in ſcrophulous diſorders: It muſt be obſerved that in this ſtate, it is a ſubſtance of an entirely different kind from the crude Sponge.

Half an ounce of choice Sponge, cut in ſmall pieces, being digeſted and boiled in water, and afterwards in rectified ſpirit, the watery decoctions left on being evaporated thirty grains of extract, and the ſpitituous three grains; three drams twenty-ſeven grains remaining undiſſolved. On inverting the order of applying the two menſtrua, the proportions turned out ſomewhat different: For the ſame quantity being treated firſt with ſpirit and then with water, I obtained of ſpirituous extract five grains, and of watery twenty-five; the reſiduum weighing three drams and a half.

The watery extracts taſted ſaline, and ſmelt of the Sponge: The ſpirituous had a ſweet kind of ſmell and a ſlightly ſaline taſte; that made by ſpirit aftewater had a degree of bitterneſs, which the others diſcovered nothing of. In evaporating the tincture made by ſpirit at firſt, the matter which the ſpirit had diſſolved, began to ſeparate, and formed a yellowiſh-green tranſparent ſlime upon the ſurface; which in the progreſs of the evaporation, fell to the bottom, and conſtituted the extract. In diſtillation, the ſpirit aroſe unaltered; but the diſtilled water had a ſtrong ſmell like that of ſea-weeds or freſh Coralline.

SPONGE.

All the mineral acids totally diſſolved Sponge, by the aſſiſtance of a gentle heat, but with different degrees of facility: The nitrous acid diſſolved it moſt readily, the vitriolic more ſlowly, and the marine the moſt ſlowly of the three. Spirit of Sal ammoniac, Oil of Tartar per deliquium, and Lime water, had little or no effect, though the Sponge was boiled with the two laſt, for a conſiderable time.

Sponge analyſed by fire, gives indubitable proofs of an animal nature, which is much more ſtrongly marked in this ſubſtance than in the Corals or Corallines. Laid on burning coals, it yields the ſame fetid ſmell that horns, bones or feathers do: Diſtilled in cloſe veſſels, by a ſtrong fire, it gives over a larger quantity of a concrete volatile Salt, than thoſe bodies themſelves, agreeing in this reſpect with Silk.

Mr. Geoffroy informs us, in the Memoirs of the French Academy of Sciences, that ſixteen ounces of Sponge were reduced by drying to eleven ounces; that from theſe he obtained one ounce four drams and a half of phlegm, one ounce and a half of urinous ſpirit, one ounce four drams and a half of volatile Salt, and half an ounce of empyreumatic Oil; and that the Caput mortuum, calcined and elixated with water, gave half an ounce of a fixed Salt, not purely alcaline, but of the marine kind.

Count Marſigli diſtilled five ounces of Sponge, and obtained from this quantity half an ounce of phlegm, one ounce two drams of firſt ſpirit, ſeven drams of a ſecond oily ſpirit, two drams ten grains of volatile Salt, and thirty-ſeven grains of fixed Salt: See his *Hiſtoire phyſique de la mer, Partie* iv.

I ſubmitted to the ſame operation four ounces of Sponge, well waſhed and dried and cut in pieces. There aroſe two ounces and a half of liquor phlegmatic

SPONGE. tic and urinous, one dram of empyreumatic Oil, and ſeven drams of volatile Salt. The Caput mortuum, which weighed one ounce ſix drams, being incinerated in the open air, and elixated with water; the Ley on ſtanding for ſome time, depoſited twenty-ſeven grains of a cryſtalline Salt, and the remaining liquor, inſpiſſated, left eighteeen grains more of ſaline matter. The pure earth weighed two drams two ſcruples and five grains.

SECT. VII.

HAIRS, FEATHERS, &c.

HAIR, &c. THESE kinds of ſubſtances give out very little to watery or to ſpirituous menſtrua; but are powerfully acted upon by acid and by alcaline liquors aſſiſted by a boiling heat. Hair diſſolves totally in Spirit of Nitre, into a yellow liquor, which if ſaturated with the Hair, in a boiling heat, depoſites a part in cooling, in form of a whitiſh mucilaginous ſubſtance. Cauſtic alcaline Ley likewiſe diſſolves, by a boiling heat, Hair, Feathers, and Wool. How theſe bodies may be dyed of a variety of colours, we have formerly ſeen under the heads of the colouring materials. I ſhall here relate the analytical experiments I have made upon them by fire: The quantity employed in each of theſe experiments was ſixteen ounces:

Sixteen ounces of human Hair, diſtilled with a fire gradually increaſed, gave over in all, eleven ounces and five drams. On ſeparating the ſeveral diſtilled matters from one another, I had five ounces ſix drams of urinous ſpirit; two ounces one dram of volatile Salt; and three ounces ſix drams of empyreumatic Oil. The Caput mortuum weighed four ounces three drams, and on being calcined in an open fire loſt five drams: From the white aſhes I extracted, by elixation with water, twenty-one grains of a fixed Salt.

From ſixteen ounces of Cows-hair there diſtilled eleven ounces and a half: The urinous ſpirit weighed ſeven ounces four drams; the volatile Salt one ounce ſix drams; and the empyreumatic Oil two ounces two drams. There remained in the bottom of the diſtilling veſſel four ounces four drams of a black coal; which in calcination to whiteneſs loſt four drams. From the white calx were extracted twenty-ſeven grains of ſaline matter.

The total of the diſtilled matter from Horſes hair was two ounces leſs than from Cows hair. There were of urinous ſpirit ſix ounces four drams, of concrete volatile Salt one ounce ſix drams, and of empyreumatic Oil one ounce two drams. The Caput mortuum weighed five ounces ſeven drams, and loſt ſeven drams on being calcined: On elixation, it yielded ſix grains of fixed ſaline matter.

Hogs briſtles yielded more volatile Salt (the moſt important product in theſe kinds of experiments) than the Hair of Cows and Horſes, but a little leſs than human Hair. From ſixteen ounces there aroſe in all eleven ounces and a half, and the remaining coal weighed four ounces and a half. The urinous ſpirit amounted to ſeven ounces and a half, and the Salt to two ounces; the quantity of Oil was the ſame with that of the Salt. The Caput mortuum weighed, when calcined to whiteneſs, three ounces ſix drams; and gave out to water twenty-four grains of fixed Salt.

Sheeps Wool gave juſt as much volatile Salt as the Hogs Briſtles, but a little leſs ſpirit, and a little more Oil. The whole of the diſtilled matter weighed as in the former experiment, eleven ounces and a half; the ſpirit, ſeparated from the reſt, weighed ſeven ounces, and the Oil two ounces and a half. The quantity of Caput mortuum was three ounces ſix drams, which loſt in calcination only two drams. From the calx were obtained by water thirty grains of fixed ſaline matter.

Feathers may not improperly be ranked in this claſs of bodies——The Feathers of poultry yielded more vo-

Hair, &c. volatile Salt than any of the ſubſtances above-mentioned. From ſixteen ounces there aroſe in all nine ounces and ſix drams; from which, by the uſual method of ſeparation, I had ſix ounces two drams of ſpirit, two ounces two drams of Salt, and one ounce two drams of Oil. The Caput mortuum weighed ſix ounces and a half, and loſt in calcination juſt an ounce. Twenty-ſix grains of Saline mater were elixated from the calx.

Of all the animal ſubſtances I have examined, there are very few that yield near ſo much volatile Salt as Silk does. From ſixteen ounces of Silk there aroſe in diſtillation nine ounces of mixed matter: On ſeparating the diſtilled matters, I had four ounces two drams of urinous ſpirit three ounces ſix drams of volatile Salt, and one ounce of empyreumatic Oil. The Caput mortuum weighed ſeven ounces, and loſt an ounce on being calcined to whiteneſs, By elixating the calx, I obtained forty grains of fixed ſaline matter,

It may here be obſerved, that as all theſe inſipid ſubſtances, poſſeſſed of no medicinal powers, yield nevertheleſs a notable quantity of volatile Salt, and even more than ſome of thoſe that are medicinally the moſt active; it follows, that the theory cannot be juſt, which makes the medicinal activity of animal matters to depend upon the volatile Salt producible from them, and aſcribes particular virtues to particular bodies in conſequence of their affording even an inconſiderable quantity of this Salt. If Cochineal for inſtance yields a volatile Salt on being analyſed by fire, can this be any foundation for its uſe as a medicine, when Hair, and Wool, and Feathers, yield twice or thrice as much.

Leather. To the foregoing analyſes it may be proper to ſubjoin that of Leather. The ſeveral kinds of Leather are the ſkins of different animals, differently prepared; macerated for a length of time with Lime and water, to promote the ſeparation of the Hair or Wool and of the fat and fleſhy parts; then tanned by maceration with certain aſtringent ſubſtances, particularly Oak-

LEATHER.

Oak-bark (h); and afterwards ſuppled and ſtained by oily and certain colouring drugs. Both ſkins and prepared Leather give out, on being boiled with water, a large quantity of a ſtrong Glue; in which reſpect they differ conſiderably from the ſubſtances above-mentioned, to which, in their analyſis by fire, They bear a great reſemblance.

From ſixteen ounces of cuttings of Leather, there diſtilled in all nine ounces and a half: The urinous ſpirit weighed ſix ounces and a half; the volatile Salt one ounce ſix drams: and the empyreumatic Oil, one ounce two drams. The Caput mortuum weighed five ounces ſeven drams, and when calcined to whiteneſs five ounces; the ſaline matter extracted from it, ſix grains.

SECT. VIII.

ANIMAL FLESH.

FLESH.

THE nutritious matter of animal Fleſh is a ſubſtance of the gelatinous kind; which water by long boiling diſſolves and extracts, from ſome ſorts of Fleſh more readily and more completely than from others. If the coction is performed in cloſe veſſels, and the liquor ſkilfully exhaled to a due conſiſtence, it yields a ſolid extract, which on ſome occaſions may be a ſerviceable preparation; as when thoroughly dried it keeps well, and may be again diſſolved by warm water into a liquor approaching in quality to a freſh decoction of the animal ſubject.

(h) *Tanned by Oak-bark.*] The uſe of Oak-bark in tanning depends wholly upon its aſtringent quality, by which it contracts the fibres of the ſkin, makes the texture more denſe and cloſe, and the Leather of conſequence leſs pervious to water, and more durable. There are many other vegetable ſubſtances, which produce the ſame effects, and which might be ſubſtituted to Oak-bark: All the vegetable aſtringents, that give out their aſtringency to water or ſtrike a black colour with ſolution of Chalybeate Vitriol, are fit for this uſe, more or leſs ſo in proportion to their degree of aſtringency.

FLESH. I analyſed, by diſtillation in an open fire, dry Vipers Fleſh from Italy, and freſh Beef and Fiſh: And to ſee how far blood differs from Fleſh in the ſubſtances into which it is by this proceſs reſoluble, I made the like analyſis of Ox's blood; employing in all theſe experiments, as in thoſe of the foregoing ſection, ſixteen ounces of each of the ſubjects.

Sixteen ounces of dry Vipers gave over in all eight ounces and ſix drams: The urinous ſpirit weighed four ounces and five drams; the volatile Salt two ounces two drams; and the empyreumatic Oil one ounce ſeven drams. The remaining black coal weighed ſix ounces ſeven drams and a half; and when calcined to whiteneſs, ſix ounces three drams. From the white calx were extracted by water forty-eight grains of fixed Salt.

The freſh Beef as containing its native moiſture, yielded a much larger quantity of phlegmatic ſpirit, and a ſmaller one of concrete Salt. The whole diſtilled matter weighed fourteen ounces two drams and a half; of which the ſpirit made up thirteen ounces five drams and a half, the volatile Salt only one dram, and the empyreumatic Oil four drams. The Caput mortuum weighed one ounce four drams and a half, loſt in calcination one dram and a half, and gave out to water eighteen grains of ſaline matter.

FISH. The total quantity of diſtilled matter from the Fiſh was exactly the ſame as from the Beef, but the volatile Salt was in larger proportion. Of Spirit I had thirteen ounces two drams and a half, of concrete Salt five drams, and of Oil three drams. The Caput mortuum weighed, as that of the Beef, one ounce four drams and a half, and loſt a dram and a half in calcination: The ſaline matter, extracted from the calx by elixation amounted to twenty five grains.

BLOOD. The Ox blood I inſpiſſated to dryneſs, previouſly to the diſtillation. Sixteen ounces of freſh Blood were reduced by the evaporation to three ounces and a half; and the vapour that exhaled, being caught, was found to be mere water——The three ounces and a

half

Blood. half of dried Blood being committed to diſtillation in an open fire, there aroſe two ounces and a half, and one ounce remained. Of urinous ſpirit I had one ounce, of concrete Salt ſix drams, and of Oil ſix drams. The Caput mortuum loſt in calcination one dram; and water extracted from the calx ten grains of ſaline matter (*i*).

Mummy. HUMAN bodies embalmed, called MUMMIES (a word ſaid to be of oriental origin, and to ſignify *piſſaſphaltum* or Bitumen mixed with Pitch) have been brought from Egypt, counterfeited in Europe, and recommended by the ſuperſtition of former times for medicinal uſes. Some diſpenſatories have received mummy as an official; and many who have diſclaimed the uſe of it as a preparation of perhaps diſeaſed human fleſh, have nevertheleſs been prejudiced

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(*i*) *Further Experiments on Blood.* Recent blood is equably fluid, and in taſte ſomewhat ſaline. Viewed by a microſcope, it appears compoſed of numerous red globules ſwimming in a tranſparent fluid.

On ſtanding for a little time, it ſeparates into a thick *craſſamentum*, and fluid *ſerum*. By agitation, it continues fluid: A conſiſtent polypous matter adheres to the ſtirrer, which by repeated ablution with water, becomes white.

Received from the vein in warm water, it depoſites a quantity of tranſparent filamentous matter, the red portion continuing diſſolved in the water. On evaporating the fluid, a red powdery ſubſtance is left.

It congeals by froſt, and becomes fluid again by warmth; After the liquefaction it quickly putrefies. Fluid and florid Blood, expoſed to a temperate air, putrefies ſooner than ſuch as is more denſe.

Inſpiſſated to dryneſs, it leaves a dark-coloured maſs, amounting at a medium to about one fourth the weight of the Blood, of a dark colour, and a bitter ſaline taſte, eaſily inflammable, burning with a bluiſh flame. The exſiccated Blood is not diſſoluble in acid or in alcaline liquors, but gives ſome tincture to water and to Spirit of Wine, and is more powerfully acted upon by dulcified Spirit of Nitre.

Recent blood is coagulated by the mineral acids, and by moſt of the combinations of them with earthy and metallic bodies. With vegetable acids and with ſolutions of neutral Salts, it mingles equably without coagulation. Alcalies both fixed and volatile, render it more fluid, and preſerve it from coagulating.

The ſerum of Blood is more ſaline than the *craſſamentum*, and does not ſo ſpeedily putrefy. It freezes ſomewhat more difficultly than pure water, and its aqueous part evaporates, by a gentle warmth, ſomewhat more readily, leaving about one twelfth the weight of the ſerum of a ſolid yellowiſh pellucid matter. Expoſed to a heat a little greater than that of the human body, it coagulates into a ſolid maſs, without any conſiderable evaporation. Both this coagulum, and the inſpiſſated ſerum, are readily inflammable in the fire, not diſſoluble in water or in Spirit of Wine, in acid or in alcaline liquors.

MUMMY. in its favour by the balſamic and aromatic ingredients with which it is prepared. How ridiculous a pretence! Have we not balſams and aromatics in abundance, free from the diſguſtful mixture which makes, or is ſuppoſed to make the baſis of Mummy? And how much more prudent is it to uſe known ſubſtances, mixed in known proportions, than an unknown medley, of which perhaps we ſhall not [illegible] with two parcels alike.

The Mummy I examined, contained a large proportion of matter, and of a bituminous one of the Aſphaltum kind. Four ounces diſtilled in an open fire, yielded three drams of phlegm, two drams and a half of urinous ſpirit, and at leaſt nine drams of a thick Oil, of the conſiſtence of balſam: The caput mortuum calcined and elixated, yielded one dram of fixed Salt——From four ounces of the ſame Mummy I obtained, by Spirit of Wine, two ounces and two drams of reſinous extract: From the remainder I obtained, by water, five ſcruples of a gummy extract; one ounce and ſix drams remaining undiſſolved——Four ounces of the ſame Mummy, treated firſt with water, gave five drams and a ſcruple of gummy extract; and afterwards with rectified ſpirit one ounce three drams and a ſcruple of a reſinous one; the indiſſoluble part amounting to two ounces all but two ſcruples——Spirit of Wine diſtilled over from the Mummy, received little alteration in its ſmell or taſte; water, a conſiderable one.

SECT. IX.

Gelatinous ANIMAL SUBSTANCES.

JELLIES. THE ſolid parts of animals whether horny, bony, or earthy, contain more or leſs of gelatinous matter; which is extracted by long boiling in water, and recovered in a ſolid form by evaporating the decoction. It is chiefly on this gelatinous

JELIES.

tinous principle, that their ſolidity and firmneſs depend; for all of them, by the ſeparation of it, are rendered friable.

The earthy bodies contain the leaſt of this conglutinating matter; the harder bones, more; and the more flexible horns, more than any of theſe. The membranes of animals generally contain more than any of the other parts.

The oily principle of the ſubject either makes an eſſential ingredient in the compoſition of the jelly, or is extracted along with it by the water, being by its mediation rendered ſoluble in water, in the ſame manner as the Oils and Reſins of vegetables are by their Gums or Mucilages. For the jelly extracted from bones, *&c.* detonates very ſtrongly with Nitre, and yields in diſtillation a large quantity of Oil and volatile Salt; whilſt the remaining bone detonates very languidly, and affords little or no Salt or Oil. It ſeems to be the gelatinous matter, univerſally, that is the direct matrix or ſeat of thoſe particles of which the volatile Salt is formed.

From two ounces of ordinary Glue, that is, the jelly of Mutton bones (*k*), I obtained, by diſtillation in an open fire, two drams of a colourleſs phlegmatic liquor, of a ſopy ſmell, two drams of a volatile urinous ſpirit, and two drams and a half of empyreumatic Oil.

The Glues or Jellies, extracted from different animal ſubſtances, differ notably from one another, not only in quantity, but it their degree of tenacity and purity. The greateſt difference is betwixt thoſe of water and of land animals. The Glue of fiſhes is in general much the hardeſt, and leaſt eaſily penetrated by water; that of many kinds of ſea-fiſhes acquires a hardneſs approaching to that of ſtone.

(*k*) *Glue.*] Bones and ſinews, ſaid to be uſed for this purpoſe in Germany, France, *&c.* do not afford near ſo ſtrong a Glue as ſkins; from which laſt the Engliſh Glue is prepared by the tanners. The cuttings or parings are ſteeped and waſhed with water; then boiled with freſh water till the liquor begins to grow thick, when it is ſtrained through baſkets, ſuffered to ſettle, and then further evaporated, till on being poured into flat moulds it concretes in cooling into ſolid cakes, which are cut in pieces, and dried on a kind of net.

FISH-GLUE.

THE fine Glue called ICHTHYOCOLLA, Iſinglaſs, or Fiſh-glue, is extracted from a large fiſh, which is common in the Ruſſian ſeas, and often comes up into large rivers, as the Wolga, the Danube and others, in Ruſſia, Walachia, Hungary, *&c.* Many waggon loads of this fiſh are brought to Vienna, in autumn, every Friday afternoon, and ſold next morning by the pound. I have never ſeen any there above nine or ten feet long, though they are commonly deſcribed as being twenty four feet in length; nor is the mouth remarkably wide; nor have they any of the ſcales repreſented in Pomet's figure: The Cachelot or Spermaceti-Whale of that author reſembles them more (excepting in the teeth and the organs for ſpouting) than the figure which he gives as that of the Ichthyocolla fiſh. They have no bones, nor any griſtles, except a few about the head.

Ichthyocolla is prepared only in Muſcovy. It is ſaid to be made from the ſkin, tail, fins, ſtomach, inteſtines, and bladder of the fiſh; by boiling or digeſting them in water, ſtraining off the liquor, evaporating it to a due conſiſtence, then pouring the matter upon a plate rubbed with Oil or Greaſe to prevent its adhering, and cutting the cake into ſlices, which are twiſted or coiled up while ſoft into different forms, and afterwards thoroughly dried. The thin, clear, white pieces are the beſt: The large thick ones are commonly moiſt and fetid in the inſide.

Ichthyocolla diſſolves totally in water, excepting a a ſmall quantity of impure or filamentous matter, which had been caſually mingled or paſſed through the coarſe ſtrainer with it. For ſome purpoſes, it is directed to be diſſolved in Spirit of Wine: Rectified ſpirit does not act upon it in the leaſt; proof-ſpirit diſſolves it by virtue of its phlegmatic part.

By diſtillation in an open fire I obtained, from eight ounces of Ichthyocolla, four ounces two drams of urinous ſpirit, half an ounce of concrete volatile Salt, an ounce and a half of empyreumatic Oil, half a ſcruple of fixed Salt, and nine drams of earth.

Ichthy-

Ichthyocolla is employed chiefly for œconomical and mechanic uſes, as a fine Glue, for Mouth-glue, for joining cracked Porcelaine and Glaſs, for ſtiffening Silk and Gawze, for making artificial Pearls, *&c.* but more particularly for fining turbid Wines, in which buſineſs the greateſt quantities of it are conſumed. For this purpoſe, ſome throw an entire piece, about a quarter of an ounce, into a Wine caſk; by degrees the Glue diſſolves, and forms a ſkin upon the ſurface, which at length ſubſiding, carries down with it the feculent matter that floated in the Wine: Others previouſly diſſolve the Iſinglaſs, and having boiled it down to a ſlimy conſiſtence, mix it with the liquor, roll the caſk ſtrongly about, and then ſuffer it to ſtand to ſettle.

FISH-GLUE.

That Wines thus clarified, are quite wholeſome, is a little queſtionable. It is certain, that a portion of the Iſinglaſs remains diſſolved in them; and though this ſhould ſeem to be no unſalutary ingredient, as being oftentimes uſed medicinally for obtunding and incraſſating acrimonious thin humours, and reſtraining immoderate excretions, yet it is not perhaps in Wines entirely innocent. I have been aſſured by a gentleman of good experience in theſe matters, (Purveyor of the cellar to his Britannic Majeſty) that Wines fined with Iſinglaſs, eſpecially if drank a little too ſoon, occaſion ſeveral ill conſequences. I was once myſelf, after drinking only a few ounces of Sack which had thus been clarified but had not ſettled quite fine, ſeized in a little time with a ſickneſs and vomiting, followed by ſuch a vertigo that I could not ſtand upright for a minute together; the giddineſs continued, with a nauſea and want of appetite, for ſeveral days.

EGGS.

WHITES OF EGGS may be ranked among gelatinous ſubſtances, as poſſeſſing their viſcous glutinous quality, ſo as to be uſed in cements for Glaſs and Earthen ware, though they differ remarkably from the other bodies of this kind, (at leaſt, from thoſe extracted from the ſolid parts of animals,) in being not diſſolved, but hardened by boiling water. Hence their uſe for clarifying boiling liquors: Beat up into

EGGS.

a froth, and mixed with the liquor, they unite with and entangle the impure matters that floated in it, and preſently growing hard by the heat, carry them up to the ſurface in form of ſcum no longer diſſoluble in the liquid.

Whites of new laid Eggs, expoſed to the ſun in ſummer for ſome weeks, in a large glaſs veſſel, gradually loſt their fluidity, and became at length quite dry and hard: In this ſtate they did not ill reſemble in colour, conſiſtence and tranſparency, yellowiſh gum Arabic or fine Amber: They ſtill diſſolved in cold water, and formed a viſcous fluid as at firſt. Ten drams were reduced by the drying to two drams and a half; in another trial, the ſame quantity weighed when dry two drams two ſcruples.

When the white is hardened by boiling, it ſtill loſes a very large proportion of its weight on being dried: A white of an Egg boiled hard, weighing ſix drams twenty-five grains, weighed when dry only fifty-five grains: Another, which weighed ſix drams forty-ſeven grains, was diminiſhed to fifty-two grains.

White of Eggs in its liquid ſtate, expoſed to a gentle warmth, grows by degrees thinner and thinner, in no long time putrefies, and when putrefied greatly reſembles urine both in its appearance and qualities.

When beaten up into froth and ſuffered to ſettle, it divides into two parts; a thick one which falls to the bottom, and a thin fluid which floats above.

Mixed with rectified Spirit of Wine, it is coagulated or hardened, nearly in the ſame manner as by heat; this effect ſeems to ſucceed beſt, when the two liquids are taken in equal quantities. It mingles uniformly with cold water, or ſuch as is juſt warm; and with Vinegar and other vegetable acids.

By the acids of the mineral kingdom it is coagulated, but ſomewhat differently by the different acids. Spirit of Nitre acts on it the moſt powerfully: When gradually mixed with this, it becomes firſt white, then of a Sulphur-yellow colour, thickens more and more, ſwells up into bliſters, and at laſt grows quite tenaci-

EGGS.

ous and conſiſtent, ſo as not to run out upon inverting the glaſs. With Spirit of Salt, it turns firſt white and curdly; on ſhaking the mixture, it looks much like ſkimmed Milk. Oil of Vitriol renders it ſlimy and tenacious; but on ſtanding, the mixture grows thin and fluid, and at the ſame time yellow.

Solutions of Alum, white Vitriol, and green Vitriol, mingle equably with white of Eggs, excepting that a very ſmall portion of flaky matter ſeparates: Solution of blue Vitriol partly coagulates and renders it ſlimy: By ſtrong agitation continued for ſome time, all theſe mixtures in ſome degree coagulate.

Cauſtic Ley mixed with white of Eggs ſeemed at firſt to coagulate it, eſpecially when the white was previouſly beat up into froth; but on ſtanding for a little time, the whole became fluid again. Common Ley and Spirit of Sal ammoniac mingled without coagulation, only a little flaky matter appearing at laſt to float about in the liquor.

Sixteen ounces of whites of Eggs, diſtilled in a glaſs retort, at firſt in a ſand-heat and afterwards in an open fire very gradually increaſed, gave over thirteen ounces ſix drams and two ſcruples of phlegm which had neither ſmell nor taſte; five drams and half a ſcruple of a volatile urinous empyreumatic ſpirit; three drams of fetid Oil; and three drams and a half of volatile Salt: The Caput mortuum was black, ſpongy, bliſtery, and very light, and weighed five drams twenty grains.

I diſtilled alſo in the ſame manner two ounces of the whites boiled hard: There aroſe two drams and a half of inodorous and inſipid phlegm, half an ounce of volatile urinous ſpirit, thirty-five grains of empyreumatic Oil, and fifteen grains of volatile Salt: The remaining coal weighed two ſcruples: The Caput mortuum calcined white, was reduced to an inſipid earth, entirely deſtitute of Salt.

It is obſervable that boiled whites of Eggs partly liquefy on being kept in a moiſt cellar; and that powdered Gummy-reſins, as Myrrh, incloſed in the white, partly diſſolve or deliquiate along with it.

EGGS.

It is commonly ſuppoſed, that the pure Reſins alſo, as Maſtich and Benzoine, are diſſoluble in the ſame manner; and ſeveral preparations of this kind have been kept for medicinal uſe. But experiment has ſhewn that theſe *Oils per deliquium*, as they are called, receive no impregnation from the pure Reſins; that when Gummy-reſins are uſed, it is ſtrictly only the gummy part of the drug that is diſſolved by the aqueous liquid afforded by the Egg; and that by the mediation of the Gum, a portion of the Reſin is rendered ſoluble in this liquid as in common water. All that deliquiates with the white of Egg, will diſſolve at leaſt equally in ſimple water.

YOLK of EGGS.

YOLKS of Eggs mingle uniformly with water, but on ſtanding ſeparate again and fall to the bottom: Mixed with Oils, Balſams, Reſins, or animal Fats, they render theſe alſo diſſoluble in water.

They contract no union with rectified Spirit of Wine, however agitated with it, but are in ſome meaſure coagulated or thickened.

Spirit of Vitriol and Spirit of Salt coagulate them into a butyraceous conſiſtence; Spirit of Nitre renders them ſlimy and gluey; Vinegar and alcaline Ley diſſolve or dilute them; Spirit of Sal ammoniac and cauſtic Ley thicken them, with this difference, that the mixture with the former grows thinner on ſtanding, whilſt that with the latter continues longer thick.

Yolk of Eggs, dried, does not become tranſparent and horny like the white, but opake and hard: Nor does it loſe near ſo much in the exſiccation; a boiled yolk, weighing four drams thirty-ſix grains, was reduced only to two drams thirty grains. An expreſſed Oil is obtained from the hard-boiled yolks, by beating them ſmall, keeping them ſtirring over a gentle fire till the ſuperfluous humidity is evaporated, and then committing them to a warm preſs.

Sixteen ounces of freſh yolks, diſtilled in a glaſs retort with a well graduated fire, gave over five ounces of phlegm, which had no ſmell or taſte, two ounces and a half of a very ſlightly empyreumatic phlegm, YOLK of EGGS.

one ounce ſix drams of a volatile empyreumatic ſpirit, one dram of a thin empyreumatic Oil, and five ounces half a dram of a thicker, groſſer, heavier and darker-coloured Oil: The Caput mortuum was black, compact and ponderous; and weighed an ounce and a half.

From two ounces of yolks boiled hard, there aroſe two drams of inſipid and inodorous phlegm, ſeven drams of empyreumatic phlegm, a ſcruple of volatile ſpirit, and five drams ten grains of empyreumatic Oil: The Caput mortuum weighed a dram and a half, and in appearance reſembled the foregoing. In both theſe diſtillations, a little volatile Salt begun to concrete about the ſides, but the liquor that followed, diſſolved and waſhed it down.

EGGS.

OF an Egg which entire weighed 960 grains, the white amounted to 587 grains, the yolk to 249, and the ſhell with its ſkin to 124: Of another Egg, weighing 1015, the white weighed 640, the yolk 250, and the ſhell 125.

An Egg weighing 800 grains, loſt, on being boiled hard, 20 grains. In keeping there is alſo a ſenſible diminution of weight; a part of the ſubſtance of the Egg tranſpiring through the pores of the ſhell: When a conſiderable vacuity is thus formed within the ſhell, the Egg begins to putrefy.

Eggs are commonly preſerved by packing them up cloſe in bran, ſaw-duſt, or other like ſubſtances. I kept one in ſalt-water from May to November; and notwithſtanding the warmth of the ſeaſon, and that of a fire occaſionally, it continued perfectly ſweet; but the yolk was a little harder than that of a freſh Egg, and the white had received a ſlight ſaltiſh taſte, a proof of the poroſity of the ſhell (*l*). SECT.

(*l*) *Eggs—perſpiration*, &c.] Mr. de Reaumur has diſcovered that Eggs may be preſerved perfectly ſweet for years, by rubbing them, as ſoon as laid, with fats, oils, or other unctuous ſubſtances, which by preventing their perſpiration prevent their corruption. See his *Hiſtory of Inſects*, vol. 2. the *Memoirs of the French Academy of Sciences* for the year 1735, and his *Practice of the art of hatching and bringing up domeſtic Birds*. From ſome experiments I have made on this ſubject it appears, that ſolid fats impede the Perſpiration greatly, but ſoft Fats and Oils not near ſo much. The principal of theſe experiments are as follows,

New

EGGS.

New laid Eggs,	*Perſpired in three months*
Steeped twenty hours in rectified Spirit of Wine, then hung up in a dry room	$\frac{1}{3}$
Kept in bran	$\frac{1}{10}$
Kept in ſand	$\frac{\text{[illegible]}}{12}$
Dipt in Oil, and kept in a Tin box cloſely covered	$\frac{1}{90}$
Dipt in melted fat, and kept in bran	$\frac{1}{274}$
Kept immerſed in rectified Spirit of Wine	*Nothing*

THE author above mentioned obſerves, in his treatiſes of hatching and bringing up domeſtic fowls, that Eggs perſpire in incubation between one ſixth and one fifth of their fluid contents; and that when perſpiration is prevented by unctuous ſubſtances, the Egg produces no embryo, and continues ſweet through the whole proceſs of incubation.

It may be added, that too copious a perſpiration, though the heat be no greater than under the hen, deſtroys the embryo; and that this is the principal cauſe of the ill ſucceſs complained of by thoſe who have attempted the artificial hatching of birds in England.

Thoſe who have employed for this purpoſe ovens warmed by culinary fire have been ſolicitous only, with Mr. de Reaumur, about keeping the *heat* within proper limits, or as nearly as poſſible to that of the human body, marked 32 on Reaumur's thermometer, and 95 or 96 on Fahrenheit's . . . . I had a ſmall oven, ſupplied with warm air from an athanor furnace in which a conſtant fire was kept up for other purpoſes: I contrived for it a regulating thermometer, which, as often as the heat exceeded but a very little that of the human body, ſtopt the aperture by which the warm air was admitted; and which, as often as the heat fell a little below the human, opened it again, ſo as to let in more warm air. A more equable or favourable heat could not be wiſhed for: The chickens nevertheleſs periſhed in the ſhell, and not a ſingle one lived to the time of hatching. After many fruitleſs repetitions of the experiment, an exceſs of perſpiration occurred as the moſt probable cauſe of the failure: Accordingly a quantity of Eggs was weighed from day to day, both in the oven and under a hen: Thoſe in the oven loſt daily about $\frac{1}{112}$ of their weight, and thoſe under the hen only $\frac{1}{130}$.

Mr. Cederhielm, in a paper on the artificial hatching of Eggs, in the Swediſh Tranſactions for the year 1748) finds that a degree of moiſture is neceſſary as well as heat. He obſerves, that the hen, beſides her natural perſpiration, often waſhes herſelf in water, and goes immediately to cover her Eggs. Hence he was led to moiſten his egg-boxes every day.

Reaumur's principal experiments were made in caſks ſet in hot-beds of dung; the egg-baſkets being ſupported at proper heights in the caſk, a thermometer placed commodiouſly to be conſulted from time to time in regard to the heat, and a number of holes made in the cover, to be opened or cloſed according to the exceſs or deficiency of heat——The copious moiſt, fetid vapours, to which the Eggs are here expoſed, prove often fatal to the embryo; and a good deal of care is requiſite to ſecure them from theſe vapours. This Mr. Reaumur very often experienced; and it is by this he ſeems to havr been miſled. Having ſo often ſeen the ill effects of the redundant moiſt vapours of dung, he thought it a grand advantage, in ovens warmed by culinary fire, to have no moiſture at all.

SECT. X.

Unctuous Parts of ANIMALS.

FAT. FAT is an unctuous ſubſtance, ſecreted from the blood, and lodged chiefly in the *Membrana adipoſa.* Strong exerciſe, preternatural heat, an acrimonious ſtate of the juices, and other like cauſes by which the oily parts of the blood are attenuated, reſolved, or evacuated, prevent the generation of fat: Labours of the mind alſo have this effect, as well as labour or intemperature of the body. Hence reſt and plentiful food are ſufficient to fatten brutes, but in men it is often otherwiſe. It is ſurprizing how ſoon ſome birds grow fat; Ortolans in four and twenty hours, and Larks ſtill ſooner.

Fats may be divided, from their conſiſtence, into three kinds; (1.) The ſoft and thin, which grow perfectly liquid in a very ſmall heat; (2.) The thick or conſiſtent, which liquefy leſs readily; and (3.) The hard and firm, which require a ſtill ſtronger heat to melt them. The firſt is called *Pinguedo*; the ſecond *Axungia*; and the third *Adeps* as taken from the animal, and *Sebum* or *Sevum* when freed from the ſkins, *&c.* This uſe of the names is not however conſtant, ſome applying them differently.

In birds, reptiles, and fiſhes (the very large fiſhes excepted) we find only the firſt kind, or the thin fat, in quadrupeds chiefly the two laſt, in ſome moſt of the one, and in others of the other.

A great number of fats have been kept in the ſhops, for making ointments, plaſters, and other medicinal compoſitions; as Hog's Lard, the fat of the Boar, the Fox, the Hare, Dog, wild Cat, Alpine Mouſe, Beaver; of Hens, Ducks, Geeſe, Storks; of the Whale, Pike, Serpents, Viper, *&c.* as alſo human fat.

FAT.

Purification.

In regard to all theſe kinds of ſubſtances, much depends upon the manner of purifying or trying, and of keeping them, for they are very apt to ſpoil and grow rancid. Dioſcorides directs them to be barely melted in a gentle warmth: Some previouſly waſh them in hot and cold water, or in Wine, but either of theſe liquors do more harm than good. Simple fuſion in a water bath or other gentle heat is ſufficient; the ſkins, fibres, and blood veſſels being previouſly ſeparated, and the melted fat further purified by paſſing through a ſtrainer. If any ablution is thought neceſſary, rectified Spirit of Wine is the moſt proper liquor; for this, if any of it ſhould be retained in the fat, will be diſſipated in the melting. For the more curious and uncommon fats, the beſt way is, to clear them from ſkins, *&c*, then waſh them with rectified ſpirit, and keep them covered with freſh ſpirit, in a cloſe veſſel, in a cool cellar: A little may be ſoon melted, occaſionally, in a glaſs, and ſtrained off for uſe.

Fats taken freely as food are difficult of digeſtion, relax and weaken the tone of the ſtomach and inteſtines, and are ſuppoſed likewiſe to render the juices tenacious, and to increaſe bile. They are uſed in external applications for ſoftening and ſuppling, for abating pains and ſpaſms, and for promoting maturation: But it is proper to obſerve, that in inflammations, recent wounds, in defenſive plaſters, for varices, or where the bones are carious or laid bare, they do harm. The great number of fats which the ſhops have been accuſtomed to preſerve do not appear to be all needful: Dr. Cyprianus, who practiſed ſurgery in London, ſcarcely employed in his own practice any fats at all.

Formerly human fat was held in great eſtimation, and incredible virtues were aſcribed to it. Some endeavoured to ſubtilize, and prepare a quinteſſence from it by diſtillation from bricks, aſhes, and other additions: Agricola, to make the ingredients more homogeneous, diſtils it from human bones. When thus ſubtilized, it is ſaid to be of inexpreſſible activity and penetration, inſomuch that when rubbed on the palm of the hand it is felt in the twinkling of an

eye,

FAT.

eye, at the back-bone: So great is the efficacy of a diſtempered imagination.

Analyſis of Fats.

THOUGH fats differ from one another not a little in their obvious properties, and probably alſo in their medicinal and dietetic qualities; they afford, upon a chemical analyſis, products ſimilar in quality, and differing but inconſiderably in quantity. They all yield a large proportion of Oil, and no volatile Salt; in which laſt reſpect they differ from the other ſubſtances of the animal kingdom.

Fat of a Gooſe.

TWO ounces of the fat of a Gooſe being diſtilled in a glaſs retort, at firſt in a ſand heat and afterwards in an open fire; there aroſe one dram of a ſlightly empyrumatic liquor, and one ounce ſix drams fifty grains of a clear brown coloured Oil of a volatile ſmell ſomewhat like that of Horſe-radiſh. The Caput mortuum was of a ſhining black colour, and weighed ten grains.

Hog's Lard.

Two ounces of Hog's Lard gave two drams of empyreumatic liquor, and one ounce five drams fifty grains of Oil, of the ſame volatile ſmell with the foregoing; the Caput mortuum was alſo of the ſame black colour, and of the ſame weight; ſo that this fat differs from the foregoing, only in yielding a dram more of empyreumatic liquor or phlegm, and a dram leſs of Oil.

I examined Lard with different menſtrua, as well as by fire; namely, rectified Spirit of Wine, Water, the acid Spirit of Vitriol, Nitre and Sea-Salt, Spirit of Sal ammoniac, common alcaline Ley, and cauſtic Ley: None of theſe liquors diſſolved, or had any effect upon it, in the cold, or when aſſiſted by a moderate heat, except that the Spirit of Sal ammoniac ſeemed, by its turbidneſs, to have taken up a little of the fat. By boiling, it unites perfectly, like other fats, with cauſtic Ley, and forms with it a ſaponaceous maſs.

Tallow.

TALLOW, of common uſe for making Sope and Candles, being diſtilled as the two foregoing fats, I obtained from two ounces of the Tallow, of empyreumatic liquor two drams; and of a clear brown Oil, which ſmelt like Horſe-radiſh, one ounce ſix drams

TALLOW.

twelve grains. The remaining coal was of a ſhining black colour, and weighed eighteen grains.

MUTTON SUET.

TWO ounces of Mutton-ſuet, yielded one dram and a half of empyreumatic liquor, and one ounce ſix drams fourteen grains of Oil: The ſhining black Caput mortuum weighed ſixteen grains.

Thus we ſee how little differences there are even in the proportion of the principles, into which different fats hard and ſoft, are reſoluble by fire.

MARROW.

THE MARROW of bones differs a little from the direct fats in its chemical analyſis; as well as in its pleaſanter taſte.

Four ounces of the freſh Marrow of the leg-bone of an Ox, committed to a warm preſs, paſſed nearly all through the bag, in form of a fine liquid fat, which hardened in cooling like other fats; only one dram of fine fibres and membranes was left.

The ſtrained Marrow, digeſted in rectified Spirit of Wine, ſuffered no change, and communicated nothing to the ſpirit: By boiling four drams of the Marrow in diſtilled water, and evaporating the decoction, I obtained three grains of an extract, which had neither taſte nor ſmell: The three mineral acids, and Spirit of Sal ammoniac, had not the leaſt action on it: Strong alcaline Ley ſeemed to corrode it a little; and cauſtic Ley formed with it a conſiderably ſaponaceous compound: In theſe reſpects, it agrees ſufficiently with other fats: The principal difference is in the diſtillation.

Four ounces, diſtilled in the uſual manner, gave over three drams and a ſcruple of a liquor which ſmelt like Tallow, two ſcruples and a half of a liquor which had more of an empyreumatic and a ſouriſh ſmell, two ounces and a half of a yellowiſh-brown, butyraceous Oil which ſmelt like Horſe-radiſh, and ſix ounces and a half of a blackiſh-brown Oil of the ſame ſmell: The Caput mortuum weighed four ſcruples.

BRAINS.

THE BRAINS of land animals differ ſtill more from the direct fats, and agree nearly with the fleſhy parts. They yield in diſtillation an actual volatile

Salt;

BRAINS.

Salt; and an empyreumatic Oil, ſimilar to that obtained from fleſh, bones, *&c.* without any thing of the peculiar Horſe-radiſh ſmell of the diſtilled Oils of fats.

From ſixteen ounces of Oxes brains, cleared as much as poſſible from the membranes, there aroſe ſix ounces two drams two ſcruples of a colourleſs phlegmatic liquor, which ſmelt nearly like hung-beef; four ounces four ſcruples of a volatile urinous empyreumatic liquor or ſpirit; and four ounces and a half of empyreumatic Oil. The urinous ſpirit yielded on rectification two ſcruples of a concrete volatile Salt: The Caput mortuum, which weighed one ounce on being burnt to whiteneſs and elixated with water, gave twenty-five grains of fixed Salt, though Hoffman reports that no fixt Salt is procurable from animal brains.

SPERMACETI.

THE brain of a ſpecies of Whale, purified from the oily matter, affords a fat of a ſingular kind, known in the ſhops by the improper name of SPERMACETI.

The Spermaceti Whale, called *Cetus dentatus* and *Orca*, and by the Engliſh ſailors, employed in the Greenland-fiſhery *Trump*, *Jubart*, or *Gibbart*, is ſmaller than the common Whale, but the head is proportionably much larger, amounting to above one third the bulk of the whole body. He is furniſhed with teeth, which the other is not; and wants the flexible bones in the mouth, called Whalebone, which the other has. The throat is alſo remarkably wider.

One of theſe fiſhes affords ſome tuns of brains; which are firſt groſsly freed from the Oil by draining and preſſing, and afterwards more perfectly purified by ſteeping them in a Ley of alcaline Salt and Quicklime, which diſſolves the remains of the oily matter into a ſaponaceous liquid. The brains, being then waſhed with water, appear of a Silver whiteneſs; and nothing more is required to complete the preparation than to cut them in ſhivers with wooden knives, and ſpreading them abroad to dry. Such is the ſimple proceſs, by which this profitable commodity is pre-

SPERMA-CETI.

prepared. It has been ſaid that Spermaceti is a natural concrete, found floating on the ſurface of the northern ſeas; but this is plainly a falſe report, perhaps calculated to prevent enquiry into the manner of its preparation.

Good Spermaceti, is in fine white flakes, gloſſy and ſemitranſparent, ſoft and unctuous to the touch, yet dry and eaſily friable, in taſte ſomewhat like Butter, of a faint ſmell like that of Tallow.

It is apt in keeping, if not carefully ſecured from the air, to grow yellowiſh, and contract a rancid fiſhy ſmell. The more perfectly it has been purified at firſt, the leſs ſuſceptible it is of theſe alterations; and after it has been ſo changed, it may be rendered white and ſweet again, by ſteeping it afreſh in a Ley of alcaline ſalt and quick-lime.

It melts in a ſmall degree of heat, and congeals again as it cools. Laid on burning coals, it emits a fetid ſmell, like that of the ſnuff of a candle. The contact of flame does not ſet it on fire, but with a wick it burns equally with common Tallow-candles.

In diſtillation, it totally ariſes, leaving no coal or Caput mortuum behind. From four ounces were obtained three ounces and a half of Oil, and a dram and a half of ~~phlegm; the~~ other two drams and a half having been waſted or diſſipated in the proceſs. The Oil is not a brown or black fetid empyreumatic one, like thoſe of other animal ſubſtances; but clear, yellowiſh, of a butyraceous conſiſtence, in ſmell like Oil of Wax, like which alſo it coagulates in the cold.

Rectified Spirit of Wine, digeſted and boiled with Spermaceti, takes up about half a dram out of half an ounce: Greateſt part ſettles to the bottom, and the finer particles float in the liquor, in appearance like flowers of Benzoine.

Water long digeſted or boiled with it, extracts nothing. By grinding it with Sugar or Almonds, it becomes miſcible with water, but not near ſo perfectly as the vegetable Reſins do by the ſame treatment;

SPERMA-CETI.

on ſtanding for a little time, the Spermaceti ſeparates and floats on the ſurface. Yolks of eggs unite it more thoroughly with watery liquors: but when diſſolved by theſe alſo it ſoon ſeparates, and falls to the bottom.

Even cauſtic alcaline Ley does not diſſolve, nor unite with it into Sope, as it does with all other fats; and hence the uſe of this Ley in its preparation and purification. It mingles ſufficiently with Oils, Fats, Balſams, Reſins, Butter, Wax, *&c.*

TRAIN OIL.

THE common Whale contains an immenſe quantity of ſoft fat, which liquifies in a gentle warmth; Hence the animal cannot live in ſeas that are but moderately warm, and is found only in the cold northern ones, about Greenland, Iceland, *&c.*

Common Train-oil is the fat of the Whale, melted out from the fleſhy parts. The French extract it in Greenland from the freſh Blubber; whereas the Engliſh, Dutch, *&c.* bring home the the fiſh itſelf, cut in pieces, which putrefying by the length of time, give a more offenſive Oil.

Sixteen ounces of Train-oil yielded in diſtillation an ounce of phlegm, and twelve ounces and a half of empyreumatic Oil: The remaining coal weighed one ounce and a half.

CIVET.

ODORIFEROUS unctuous juices are ſecreted in the inguinal region of certain animals, and depoſited in particular bags. CIVET, uſed in perfumes, is collected betwixt the anus and the organs of generation of a fierce carnivorous quadruped, met with in China and the Eaſt and Weſt-Indies, called a civet *Cat*, but bearing a greater reſemblance to a Fox or a Martin than a Cat.

Several of theſe animals have been brought into Holland, and afford a conſiderable branch of commerce, particularly at Amſterdam. The Civet is ſqueezed out, in ſummer every other day, in winter twice a week; the quantity procured at once is from two ſcruples to a dram or more.* The juice thus collected is much purer and finer than that which the animal

CIVET. ſheds againſt ſhrubs or ſtones in its native climates.

Good Civet is of a clear yellowiſh or browniſh colour; not fluid, nor hard, but about the conſiſtence of Butter or Honey, and uniform throughout; of a very ſtrong ſmell, quite offenſive when undiluted, but agreeable when only a ſmall portion of Civet is mixed with a large one of other ſubſtances.

This commodity is rarely or never to be met with genuine, notwithſtanding the ſealed bottles in which it is purchaſed at Amſterdam. Nor have we any certain criteria for diſtinguiſhing its adulteration. Some look upon it as genuine, if when rubbed on paper, it ſinks in, without leaving any thing upon the ſurface; and if, when melted in hot water, it totally ſwims a top: But Lard and Butter, the ſubſtances principally mixed with it, have both theſe properties, equally with the Civit itſelf.

Civit unites eaſily with Oils, both expreſſed and diſtilled, but not at all with Spirit of Wine, nor with water: Nor is it rendereed miſcible with water by the mediation of Sugar. Boecler relates, that Sugar and rectified Spirit are its two beſt menſtrua; but he has certainly never made the experiment with either. The yolk of an Egg ſeems to diſpoſe it to unite with water; but in a very little while, the Civet ſeparates from the liquor and falls to the bottom, though it does not prove of ſuch a reſinous tenacity as when treated with Sugar and Spirit of Wine.

It communicates however ſome ſhare of its ſmell both to watery and ſpirituous liquors: Hence a ſmall portion of it is often added in odoriferous tinctures, and ſuſpended in the ſtill-head during the diſtillation of odoriferous waters and ſpirits; as thoſe of Lilies of the valley, Roſes, Rhodium-wood, Orange-flowers, Orange-peel, Yellow-ſaunders, *&c.* The Italians make it an ingredient in perfumed Oils, and thus obtain the whole of its ſcent; for Oils diſſolve the whole ſubſtance of the Civet.

MUSK

Musk.

MUSK is a concrete juice, collected in a bag, which is ſituated under the belly of an oriental quadruped, called by ſome a Goat, by others a Stag, but differing conſiderably from the animals of both thoſe claſſes; for I have ſeen both the dried ſkin and the animal alive. Of all the figures I have met with in books, Pomet's comes the neareſt to it. The Muſk-bag has no external opening like that of the Civet Cat; and hence the Muſk is not to be got at till the beaſt is killed. I obſerved however, that the apartment in which he was kept, ſmelt exceeding ſtrongly of Muſk: and that on the whited walls, where he rubbed himſelf, there was an unctuous matter of the ſame ſcent.

Two ſorts of Muſk are diſtinguiſhed in trade; one incloſed in the bags, and the other taken out of them; and each of theſe is ſubdivided, from the countries whence it is brought, into Tunquin or Eaſt-Indian, and Muſcovy or Perſian Muſk. The Tunquin bags have commonly ſmall browniſh hairs; the Perſian, larger white ones. The former are accounted the beſt; but the difference ſeems to be only in the quantity, and not in the quality, of the Muſk; the thinner and leſs hairy ones containing more, in proportion to their weight, than the others.

As Muſk is one of the deareſt of the drugs, it is for the moſt part grievouſly adulterated. Some think to avoid being impoſed on by buying the entire bags: But the more ingenious artiſts have contrived means of opening them, taking out great part of the Muſk, filling them with baſe materials, and cloſing them up again ſo as not to be diſtinguiſhed; ſometimes pieces of Lead are introduced, to increaſe the weight; Some bags are entirely counterfeit, the bag being made of the ſkin of other animals, and the contents only ſcented with Muſk.

Sundry criteria of the genuineneſs of Muſk are mentioned by authors, but as none of them are anywiſe to be depended on, they need not be enumerated here. The only way of judging whether it is genuine

MUSK. genuine or good, is, to compare it with ſpecimens known to be ſo.

With regard to its appearance, it is either of a browniſh-black or a ruſty reddiſh colour, ſometimes clotty like coagulated blood, dry with a kind of unctuoſity to the touch. Its taſte is ſomewhat bitteriſh; its ſmell extremely ſtrong, diſagreeable when ſmelt near to, or in large quantity, but to moſt people very agreeable at a diſtance, or when diluted with a very large admixture of other matters.

Of all the natural ſubſtances I know, Muſk has the ſtrongeſt ſmell; and great care is requiſite in keeping it, to prevent the diſſipation of this volatile principle, in which its virtue conſiſts. The uſual way is to ſecure it in a cloſe ſtopt glaſs; to incloſe this in a leaden caniſter to tie a piece of bladder round the juncture; and place the whole in a cool dry cellar: Warmth would promote the exhalation, and moiſture would occaſion the Muſk to ſpoil and grow mouldy.

The ſmell of muſk is remarkably diffuſive, and remarkably tenacious: Every thing in its neighbourhood becomes preſently infected with it; and what has once received, retains it long; A ſilver cup that has had Muſk in it, does not eaſily part with the ſcent, though other ſmells are in general very readily diſcharged from metalline bodies. Some report that Muſk which has loſt its ſmell recovers it again on being hung in a privy; and that this is the common practice among the perfumers.

Thirty grains of Muſk, digeſted with water, gave twelve grains of extract: The ſame quantity, treated with rectified ſpirit, only ten grains. The Muſk remaining after the action of water gave out four grains to ſpirit; and that remaining after the action of ſpirit gave ſix grains to water.

Spirit of Nitre and Oil of Vitriol totally diſſolve it; the former deſtroys the whole of its ſmell, and the latter greateſt part of it. The diluted acid or Spirit of Vitriol has no effect; and Spirit of Salt, and diſtilled Vinegar ſcarcely any.

MUSK.

Spirit of Sal ammoniac diſſolves a little: The dulcified Spirit of Sal ammoniac, leſs. Oil of Tartar per deliquium ſcarcely acquires any tinge from the Muſk, but extricates in digeſtion a volatile urinous ſmell, as if Muſk contained an ammoniacal Salt, whoſe acid being abſorbed by the fixed alcaline Ley its volatile Alcali is ſet at liberty.

Oils ſeem to have no action on it; for Muſk being triturated with the expreſſed Oil of Almonds, with the diſtilled eſſential Oil of Lavender, and with the undiſtilled eſſential Oil of Citron-peel, it did not diſſolve or unite with any of them.

Laid on a burning coal, it emits the ſame fetid ſmell as urine does. On diſtillling a little in a retort, I obtained the ſame products as from other animal ſubſtances, namely an empyreumatic Oil, and a volatile Spirit and Salt.

The principal uſe of Muſk is as a perfume, for cloathes, ſcented Sopes, balſams, waters, ſpirits. Some direct it in odoriferous compoſitions for burning; but for theſe purpoſes it is manifeſtly improper, as the ſmell which it yields when ſet on fire is, like that of other animal ſubſtances, very fetid and offenſive.

A ſmall portion of it, included in a linen-cloth, is commonly hung in the ſtill-head, in the diſtillation of odoriferous waters and ſpirits; the vapours of both liquors extracting its ſcent. If put into the ſtill along with ſpirit, the ſpirit which diſtills has nothing, or exceedingly little, of its ſcent; but water diſtilled over from it in the ſame manner, is extremely ſtrong both in the ſmell and taſte of the Muſk (*m*).

This

(*m*) *Musk in perfumed waters.*] The waters and ſpirits diſtilled from odoriferous vegetables, as Lavender and Roſemary-flowers, have their fragrance notably improved by ſkilfully empregnating them with a minute portion of Muſk; the Muſk, when employed in very ſmall quantity, heightening the ſmell of other odoriferous ingredients, without communicating to the compound any of its own diſtinguiſhing ſmell.

The

MUSK. This drug is ſometimes given by phyſicians as an antiſpaſmodic and corroborant; but there are many, particularly women, who cannot bear its ſmell.

CASTOR. IN the inguinal region of the BEAVER are found four oval bags, a large and a ſmall one on each ſide. In the two large is contained a ſoftiſh, greyiſh-yellow or light brown ſubſtance; which, in a warm dry air, grows by degrees hard and brittle, and of a darker and browner colour, eſpecially when dried, as it uſually is, in chimneys: This is the CASTOR of the ſhops; when freſh, it has a very ſtrong, diſagreeable ſmell, which is greatly weakened by drying. The two ſmaller bags contain a ſofter and more unctuous fat, of the ſame kind of ſmell with the Caſtor, and which is uſed by huntſmen for rubbing on their toils, as a decoy for Foxes, Martins, and other beaſts of prey, who purſue the Beaver by his ſcent.

The Beaver is an amphibious quadruped; in the fore-part like land animals; the two hinder feet ſomewhat like thoſe of water-fowls; the tail like that of fiſhes: Hence in ſome countries the hinder-part is permitted on faſt-days, and the fore-part forbidden. His habitation is curiouſly conſtructed in the banks of rivers or lakes, and divided into ſtories at different heights for retiring to when the water is high or low. He has two kinds of hair, a long coarſe, and a fine ſhort ſoft one underneath: The entire ſkin is made into muffs, and the ſhort hair into hats, *&c.*

There are Beavers in Pruſſia, Muſcovy, Poland, and other parts of Europe, but the greateſt numbers are in America, particularly Canada. All the European Beavers are of a brown or blackiſh-brown colour: Of the American, there are ſeveral fallow, ſtraw-coloured, and ſome quite white.

The beſt method of managing it for theſe perfumed liquors ſeems to be, to make a tincture from the Muſk in rectified Spirit of Wine; and drop this tincture into the liquor in ſuch quantity as ſhall be found neceſſary. This appears likewiſe to be the moſt certain way of judging of the goodneſs of Muſk; for the ſpirit extracts all its ſmell, and the quantity of liquor that may thus be ſenſibly impregnated by a certain quantity of Muſk, will be the meaſure of the ſtrength of the Muſk.

It is ſuppoſed, in Germany, that England produces Beavers; a ſort of Caſtor being diſtinguiſhed in trade by the name of Engliſh Caſtor. This is not, however, originally an Engliſh but an American drug, being brought from America into England, and from thence to us The Engliſh themſelves rarely make uſe of it, preferring that of Pruſſia, which they receive from Dantzick. The Pruſſian is undoubtedly the beſt; and next to it is that of Muſcovy.

The Caſtor of the full grown Beaver is ſuperior to that of the young; and hence the large cods are to be preferred to the ſmall. The beſt are moderately heavy, of a blackiſh brown colour, of a ſtrong penetrating ſmell, well filled with a browniſh, hard, brittle ſubſtance, of a nauſeous bitteriſh taſte, intermixed with fine ſkins or membranes.

We ſeldom meet with any conſiderable quantity of this commodity free from adulteration. Some open the cods, and having emptied them of their contents, fill them with other matters, and glue up the ſlit with Iſinglaſs ſo dextrouſly that no mark of it can be perceived. The more ſubtile maſters of deceit employ for filling the cods a compoſition greatly reſembling the Caſtor itſelf, made of blood; dried and powdered, Gum ammoniacum, Galbanum, Mummy, Reſin, Wax, *&c.* with a little powdered Caſtor, and the inguinal fat of the animal. Some make a ſmall hole in lighter cods, and introducing fine ſhot or other ponderous materials, artfully glue it up again.

An ounce of Caſtor digeſted with rectified Spirit of Wine, yielded two drams and a ſcruple of a tenacious extract: Another ounce, treated with water, gave exactly the ſame quantity of a brittle extract. The Caſtor, remaining after the action of each of theſe menſtrua, being treated with the oppoſite one, the quantities now taken up, were different; ſpirit, applied after water, extracting only a ſcruple, and water after ſpirit four ſcruples.

The two laſt extracts have hardly any ſmell or taſte. The extract made by water at firſt retains the ungrateful bitterneſs of the Caſtor, but has little or nothing

CASTOR.

nothing of its ſmell, the odoriferous principle ariſing with the water in evaporation or diſtillation: The diſtilled water ſmells exceeding ſtrongly of the Caſtor, and probably if a large quantity of the drug was ſubmitted to the operation at once, an actual eſſential Oil would be obtained *(n)*, though on diſtilling a ſmall quantity I could not ſeparate any Oil. Rectified ſpirit brings over nothing in diſtillation, the ſmell as well as the taſte of the Caſtor remaining entire in the extract. Hence we learn how unfit this drug is for an ingredient in diſtilled ſpirits, and in watery extracts; in both which it is ſtill directed in [foreign] diſpenſatories.

Caſtor has been greatly celebrated by phyſicians as an antiſpaſmodic and antihyſteric medicine; the ancients accounted it likewiſe a corrector of Opium; perhaps rather from prejudice, than from fair experience of its virtue. When given by itſelf, it is not found to produce any of thoſe mighty effects, which have been uſually attributed to it.

SECT. XI.

ANIMAL GALL.

GALL.

GALL or Bile is a bitter fluid, ſecreted from the blood in the liver, and collected in a particular receptacle; from whence it is gradually emptied into the alimentary canal, for promoting the reſolution of the aliment and the production of chyle, and for ſtimulating the inteſtines to diſcharge the feces. The Galls of different animals do not ſeem to differ conſiderably from one another: The following experiments were made on that of the Ox.

(n) *Probably would yield an eſſential Oil.*] This ſuſpicion has been confirmed by experiment, an actual Oil having been obtained on diſtilling large quantities of Caſtor at once. Dr. Cartheuſer obſerves that this Oil "is ſo ſubtile, that a ſingle drop reſolved into vapour, is capable of filling a large extent of air with the *ſpecific ſmell of the Caſtor.*" *Fund. Mat. Med. Sect.* xii. *cap.* 48.

Gall-ſtones.

THE gall-bladder of an Ox contains commonly from eight to twelve ounces of Gall. There are frequently found in it one or more calculi, ſome as large as a Pigeon's or ſmall Hen's egg, of a yellow colour like Gamboge, and compoſed of ſtrata or incruſtations like Bezoar; whence they have been called Bezoar of the Ox. Theſe ſtones are partly diſſoluble, by the aſſiſtance of a boiling heat, both in water, and in rectified Spirit of Wine.

Nature of Gall.

The freſh Gall is in part yellowiſh, in part of a browniſh-greeniſh colour, in conſiſtence ſomewhat thinner than the whites of eggs, of a very bitter taſte, and little ſmell. On keeping it grows thicker and more tenacious, at length appears turbid and cloudy, depoſites a ſediment, and putrefies.

Gall is ſuppoſed by ſome to be an acid, by others an alcaline, and by others a ſopy liquor; but it does not appear to be any one of theſe. Nothing alcaline can be diſcovered in it, till it has undergone the action of fire or of putrefaction, by which an alcali is generated in this as in other animal ſubſtances: And no acid can be diſcovered in it in any ſtate. As it contains no alcaline Salt, it cannot be ſopy; for Sope is a combination of alcaline Salt and Oil. Gall is a fluid of a peculiar kind, for we know of no other ſubſtance in nature that can be ranked in the ſame claſs with it.

Examined by acids, &c.

Spirit of Vitriol, Oil of Vitriol, Spirit of Nitre, Spirit of Sea-ſalt, and diſtilled Vinegar being dropt into ſeparate quantities of freſh Gall, each drop coagulated the part where it fell, and rendered it thick, tenacious and whitiſh (*o*). None of theſe acids occa-

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(*o*) *Bile with acids, &c.*] Though Bile is oftentimes made whitiſh by acids, Baglivi relates, that human Bile, and that of an Ox and a Sheep, were changed by acids to a green colour: Hence it is ſuppoſed that a green colour of the inteſtinal feces proceeds from acid juices mingled with the Bile. Salt of Tartar, dropt into Bile, remained in great part undiſſolved at the bottom, this fluid ſeeming to have very little action upon the Salt: The Bile nevertheleſs had its bitterneſs increaſed by the Alcali to ſuch a degree as to occaſion vomiting on being ſlightly taſted. Acids on the other hand weakened the bitterneſs, and volatile ſpirits rendered it not ungrateful. See Baglivi *Diſſertationes variæ, Diſſ.* iii. *de Bilis natura.*

GALL. ſioned any efferveſcence, except the nitrous ſpirit; which in a little time after it was added, raiſed a ſlight kind of commotion, with an emiſſion of ſome vapours.

It is chiefly from this appearance of the efferveſcence, with the nitrous acid falſely extended to the other acids, that Gall has been ſuppoſed to be alcaline; but admitting the conflict to be far greater than it is, the conſequence would by no means be juſt: Spirit of Nitre produces a violent ebullition with eſſential Oils, which are ſo far from being alcaline, that if they contain any ſaline matter it is an acid.

The coagula which Gall forms with the above acids, diſſolve on ſtanding, and at length depoſite a little Precipitate, excepting the mixture with the nitrous acid, which after the reaction is over becomes clear again.

Oil of Tartar per deliquium added to Gall, throws down likewiſe a ſmall quantity of coagulated matter. Spirit of Sal ammoniac dilutes or uniformly mingles with it, without occaſioning the leaſt alteration. Rectified Spirit of Wine alſo ſcarcely makes it cloudy.

By diſtillation. Gall diſtilled in the gentle heat of a water-bath, gives over a large quantity of an aqueous fluid. Some report, that when the Gall is previouſly digeſted, the diſtilled liquor ſmells like Muſk; and others, that the firſt runnings are inflammable: But I have never obſerved any degree either of a muſky ſcent, or of inflammability: When Gall is digeſted in a gentle warmth, it begins to putrefy, and the liquor that diſtils from it is no other than an urinous one, having the common fetid urinous ſmell, and changing Syrup of Violets green; for though recent animal ſubſtances require a ſtrong fire for generating and extricating an urinous Alcali from them, yet when the Alcali is once produced by putrefaction, it ariſes in a gentle heat.

Freſh Gall inſpiſſated and freed from its phlegm in a water-bath, yields on being diſtilled in an open fire, an urinous ſpirit, a volatile alcaline Salt, and an empyreumatic Oil; and from the Caput mortuum may be obtained a conſiderable proportion of a true fixed alcaline Salt. Eight ounces of Gall yielded ſix ounces and a half of phlegm or water, including the phlegm of the ſpirit; half a dram of volatile Salt, including the Salt in the ſpirit, and nearly four ſcruples of empyreumatic Oil. The Caput mortuum, which weighed two drams and a half, on being urged with a ſtronger fire, gave over a little thick oily matter, and a ſmall portion of yellow Sublimate: From the reſiduum were extracted, by calcination and elixation, twenty-one grains of fixed Alcali; the remaining white earth weighed, when dry, one dram and ſix grains.

I afterwards repeated the experiment with a larger quantity of Gall: From the Galls of ſeven Oxen I obtained no leſs than half an ounce and a ſcruple of pure fixed alcaline Salt; a product the more remarkable, as animal ſubſtances in general afford exceeding little fixt Alcali, and moſt of them ſcarcely any at all.

Its uſes.

Ox's Gall has been made an ingredient in external applications for cutaneous deformities, and ſometimes alſo directed by phyſicians to be given internally. In the ſhops it has been cuſtomary to inſpiſſate the Gall in a water-bath, and then extract a tincture from it with Spirit of Wine; after the inſpiſſation it almoſt totally diſſolves again both in ſpirit and in water.

In France, it is made the baſis of a coſmetic mixture: The ingredients added to it are, Alum, Sandiver, Porcelane reduced into a ſubtile powder, diſtilled Vinegar, Borax, Spermaceti, Sugar-Candy, Camphor, Mercurius dulcis; a ſtrange medley of diſcordant matters: One of the French academicians, in the Memoirs of the Academy for the year 1709, gives the following preparation of Gall for taking out freckles and ſunburn: Sixteen ounces of Ox's Gall are to be well beat up with half an ounce of powdered Alum, and the mixture ſuffered to ſtand in the ſun for two or three months; a ſediment falls

Gall.

to the bottom, amounting to more than the weight of the Alum employed; and an unctuous fat matter ariſes to the ſurface; from both which the clear reddiſh liquor in the middle is to be ſeparated: The coſmetic conſiſts of one dram of this liquor, the ſame quantity of Oil of Tartar per deliquium, and eight drams of river water, with which mixture the part is to be touched ſeven or eight times a day.

Unctuous and reſinous bodies, triturated with Gall, become ſoluble in water: Hence Gall is employed in preparing certain ſubſtances of that claſs for painting in water colours; for ſcouring, taking out ſpots, *&c.*

SECT. XII.

MILK.

Milk.

THE nutritious parts, extracted from vegetable aliments by the powers of digeſtion, appear firſt in the form of a whitiſh liquid called Chyle, which is but little removed from a vegetable nature. On drawing blood from a vein of a healthy animal, four or five hours after feeding, a portion of chyle is often found floating on its ſurface. Soon after this period, the chyle is anamalized, and in its place only a thin ſerum is to be ſeen.

Its nature and differences.

Milk is the chylous part of the blood, ſecreted by organs adapted to that uſe, and ſomewhat more aſſimilated to an animal nature, but not as yet completely ſo; the ſpecific qualities of ſundry vegetable ſubſtances, both alimentary and medicinal, remaining unſubdued in the Milk.

Thus Milk, and the Butter made from it, are found to differ greatly, in colour, conſiſtence, taſte and ſmell, according to the food of the animal (p). The human

Milk

(p) *Milk altered by the food.*] The Milk of Cows and the Butter made from it, are obſerved to receive an ill flavour from many kinds of vegetables; from all the plants of the Garlic kind, from many of the umbel-

liferous

Milk is made yellow by taking Saffron, bitter by Wormwood, and impregnated with a Garlic ſmell by eating that root: A purgative given to a nurſe purges the child at the breaſt; and the inebriative power of fermented liquors is in like manner communicated by the Milk. The ſweet ſaccharine ſubſtance ſeparable from Milk by inſpiſſation and cryſtallization, and the inflammable ſpirit by fermentation and diſtillation, proceed ſolely from its vegetable part.

That it participates alſo of an animal nature, appears from its butyraceous, fat matter, and from its analyſis by fire. If retained long in the breaſt or udder, without being recruited by freſh aliment, it changes more and more to an animal ſtate, and becomes a thin, ſaline, putrid, urinous ſerum. The more animal matter is uſed in the food, the more does the Milk participate of the qualities of animal ſubſtances, and the more it is diſpoſed to putrefaction.

Analyſis of the Milk of different animals.

The Milks of different animals, differ, in their perfect ſtate, notably from one another. It is remarkable of that of the Aſs, that it contains more than any other that has been examined, of a ſerous fluid, and leſs of a butyraceous and caſeous matter; and that when coagulated, the curd is not denſe and heavy, like that of other Milks, but rare and light.

Hoffmann evaporated eight ounces of Aſſes Milk by a gentle heat; and had only ſix drams remaining, of a whitiſh ſweet ſubſtance. He ſet by twelve ounces in a cloſe veſſel, to curdle; and having ſeparated

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ſiliquous plants, from the Horſe-mints, Cabbages, Turneps, autumnal leaves, *&c.* This ill taſte may in ſome meaſure be diſſipated from the Milk by a ſcalding heat.

Dr. Hales has diſcovered an uſeful and ſimple method of promoting the diſſipation of the more volatile parts of fluids, in a very high degree, by blowing ſtreams of air through the liquor. Stinking water, by ventilation for a little time, becomes perfectly ſweet and potable; the air carrying off the offenſive corrupted matter. By the ſame means Milk is effectually freed from its ill ſmell, eſpecially if made of a ſcalding heat whilſt the air is blown through it: It may be ſweetened by ventilation in the cold, but not ſo readily nor ſo perfectly as when heat is called in aid: See his *Account of a uſeful diſcovery to diſtil double the uſual quantity of ſea-water, by blowing ſhowers of air up through the diſtilling liquor.*

Milk.

and dried the curd, found it to amount ſcarcely to two drams, whilſt that produced from the ſame quantity of Cows Milk weighed ten drams.

Twelve ounces of Cows Milk ſet to evaporate in a tin veſſel, left one ounce five drams of a yellow clotty powder: The ſame quantity of Goats Milk left one ounce four drams and a half; of human Milk, one ounce; and of Aſſes Milk, ſcarcely an ounce.

The powder left in the evaporation by Cows Milk being boiled with twelve ounces of rain water, and the liquor paſſed through a ſtrainer, there remained one ounce three drams and a half undiſſolved, the water appearing to have diſſolved one dram and a half; on inſpiſſating the liquor, however, only a dram of ſolid matter was obtained. The powder of Goats Milk gave out to water the ſame proportion; but that of Aſſes Milk a much larger one: An ounce of this being digeſted with two pounds of water, there remained upon the ſtrainer only a dram and a half, ſo that the water had diſſolved ſix drams and a half, and accordingly upon evaporating the liquor, the reſiduum amounted to above ſix drams. The ſubſtance thus extracted by water from inſpiſſated Aſſes Milk was white, and of a ſaccharine ſweetneſs; and that obtained from human Milk was nearly ſimilar to it: That of Cows and Goats Milk was not only in leſs quantity, but far leſs ſweet.

I have obtained from Cows Milk a larger proportion of ſolid matter than Hoffmann did; a pint evaporated to dryneſs, left two ounces and two drams. The Milk of one and the ſame animal is, at different times, very ſenſibly different in conſiſtence, and conſequently in its quantity of ſolid contents. But it muſt be obſerved, that though the quantity of ſolid matter is very variable, that of the ſaline ſubſtance which water extracts from it is much leſs ſo; the proportion of this ſubſtance in Cows Milk never being near ſo large, any more than its taſte ſo ſweet, as in Aſſes and Breaſt-Milk.

Homberg diſtilled twelve ounces of Breaſt-Milk in a glaſs body, and having drawn over the phlegm by a

gentle

gentle fire, found ten drams remaining. This reſiduum, urged with a ſtronger heat, gave over two drams and half a ſcruple of fetid Oil, and ſomewhat more than half an ounce of an acid oily liquor: There was no appearance of any volatile Salt, either in a concrete or liquid form; but the Caput mortuum, calcined and elixated, gave a ſcruple of fixed Alcali, with a dram and a half of a white earth.

He repeated the experiment with Cows Milk, and found that this contained leſs phlegm, and of conſequence more ſolid matter. He obſerves that Goats Milk agrees very nearly with that of the Cow; and that Aſſes Milk has this remarkable particularity, of yielding a much more fetid ſmell in the fire than any of the others.

I diſtilled twelve quarts of Milk, in *balneo mariæ*, and obtained at leaſt nine quarts of phlegm; the liquor which now aroſe was acidulous, and by degrees grew ſenſibly more and more acid as the diſtillation was continued. After this came over a little ſpirit, and at laſt an empyreumatic Oil. The remainiug ſolid matter adhered to the bottom of the retort in form of elegant ſhining black flowers, and ſeemed in part to have penetrated and united with the Glaſs, and changed it into a ſubſtance reſembling Porcelane (*q*). This reſiduum, calcined and elixated, yielded a portion of alcaline Salt.

In du Hamel's *Hiſtoria academiæ ſcientiarum*, it is ſaid that the fixed Salt obtained from the Caput mortuum of Milk is not alcaline: I am pretty certain that mine was, for it turned Syrup of Violets green, and threw down a reddiſh Precipitate from ſolution of Mercury-ſublimate.

(*q*) *Glaſs changed into a ſubſtance like Porcelane.*] Our author appears to be the firſt who obſerved this extraordinary change of Glaſs. It was not owing however, as he ſeems to imagine, to any particularity of the earthy matter of the Milk; the ſame effect being produced by all the earthy bodies I have tried, as Sand, powdered Flint, Plaſter-of-Paris, Clay, burnt Clay, *&c.* and by iuflammable bodies, as Soot and Charcoal. Of this remarkable change an account has been already given in page 300.

BUTTER.

MILK, ſet in a warmplace, throws up to the ſurface an unctuous creme; from which by agitation, the directly unctuous part ſeparates in the form of Butter.

The addition of alcaline Salts prevents this ſeparation, not as ſome have ſuppoſed, by abſorbing an acid from the Milk, but by virtue of their property of intimately uniting oily bodies with watery liquors. Sugar, another grand intermedium betwixt Oils and water, has this effect in a greater degree, though that concrete is by no means alcaline, or an abſorbent of acids.

Analyſis of Butter.

Butter is not acted upon in the leaſt by water, though ſtrongly digeſted or boiled with it. Rectified Spirit of Wine extracts a ſmall portion, which gives no taſte or colour to the ſpirit, but diſcovers itſelf by rendering the liquor white on the admixture of water.

From ſixteen ounces of freſh Butter, diſtilled in a retort, at firſt in ſand and afterwards in an open fire, there aroſe one ounce of liquor of no remarkable ſmell or taſte; one ounce and half a dram of a reddiſh acidulous liquor, which ſmelt like burnt Butter; five drams of a browniſh-yellow Oil, three ounces three drams of a yellow Oil, one ounce ſix drams of a white, and five ounces and a half of a yellowiſh-brown one, all of a thick butyraceous conſiſtence, and a volatile ſmell like that of Horſe-radiſh; and one ounce ſix drams of a thin empyreumatic Oil, which ſmelt like the *Oleum philoſophorum*, that is Oil Olive diſtilled over from bricks. There was not the leaſt mark of any volatile Alcali in the whole proceſs. The Caput mortuum weighed three drams and a half.

CHEESE.

CHEESE is the curd of Milk, preſſed from the whey and dried: It differs in quality according as it is made from new or from ſkimmed Milk, from the curd which forms ſpontaneouſly upon ſtanding, or that which is more ſpeedily produced by certain additions, as the runnet of a Calf. Salt and ſpices are often added, and ſometimes the Cheeſe is tinged green, red or yellow, by vegetable juices. Creme alſo affords a

kind

Cheeſe.

kind of Cheeſe, but quite fat and butyraceous, and which does not long keep.

Analyſis of Cheeſe by menſtrua.

An ounce of Cheeſe, digeſted with water, yielded a dram and a half of extract, which taſted of the Cheeſe, and had likewiſe a conſiderably ſaline taſte. Rectified Spirit of Wine extracted very little: During the digeſtion with the ſpirit, the unctuous matter of the Cheeſe ſeparated, and aroſe to the ſurface in form of an Oil.

Spirit of Nitre, digeſted with Dutch Cheeſe, totally diſſolved it into a limpid liquor, excepting that a little butyraceous matter floated on the ſurface, which liquefied on applying heat, and congealed again as it cooled. Spirit of Vitriol diſſolved it only in part; the ſolution was quite dark-coloured, and threw off an unctuous matter to the top, and fine capillary cryſtallizations to the bottom. Spirit of Sea-ſalt likewiſe proved only a partial menſtruum; the ſolution was yellow, and like the two foregoing had an unctuous ſubſtance on the ſurface.

Spirit of Sal ammoniac corroded the Cheeſe totally; and Oil of Tartar per deliquium corroded it partially; both liquors were turbid, and had an oil at top. Cauſtic alcaline Ley diſſolved the whole; the ſolution was clear whilſt hot, but grew turbid on cooling; a little powdery matter ſeparated to the bottom, and a very little Oil to the ſurface——It is obſervable that the Cheeſe ſunk in Spirit of Salt and in Spirit of Sal ammoniac, but floated upon Spirit of Vitriol, Spirit of Nitre, Oil of Tartar, and cauſtic Ley.

And by fire.

On diſtilling in a retort ſixteen ounces of Dutch Cheeſe, there aroſe ſeven ounces one dram and ten grains of urinous phlegm, two ounces thirty grains of volatile urinous ſpirit, ſix drams and a half of volatile urinous Salt, and three ounces three drams and a half of empyreumatic Oil: The Caput mortuum weighed two ounces fifty grains.

How different is this analyſis from that of Milk or Butter! Inſtead of a ſmall portion of acid which thoſe ſubſtances yield, we have here a large one of volatile Alcali; a mark that the Cheeſe has ſuffered a degree

Cheese. of putrefaction, or of a proceſs analogous to that by which vegetable ſubſtances are converted into an animal nature.

Milk. Sugar of Milk. THE SWEET SACCHARINE part of the Milk remains diſſolved in the Whey after the ſeparation of the curd or cheeſy matter, and may be collected from it in a white cryſtalline form, by boiling the Whey till all remains of the curdled ſubſtance have fallen to the bottom, then filtering, evaporating it to a due conſiſtence, ſetting it to ſhoot, and purifying the cryſtals by ſolution in water and a ſecond cryſtallization. Much has been ſaid of the medicinal virtues of this SUGAR OF MILK, but it does not ſeem to have any conſiderable ones: It is from Cows-milk that it has been generally prepared; and the cryſtals obtained from this kind of Milk have but little ſweetneſs.

Whey. When Milk is ſuffered to coagulate ſpontaneouſly, the Whey proves acid, and on ſtanding grows more and more ſo till the putrefactive ſtate commences. Sour whey is uſed as an acid, preferably to the directly vegetable or the mineral acids, in ſome of the chemical arts; as for diſſolving Iron in order to the ſtaining of Linen and Leather (r).

Thick Milk. It is obſervable that Aſſes milk is greatly diſpoſed, on ſtanding for a little time, to become thick and ropy. In the Breſlau collection for the year 1720, there is a remarkable account of Milk (which probably was that of the Aſs) grown ſo thick and tenacious s to be drawn out into long ſtrings, which when dried were quite brittle (s).

(r) *Sour milk.*] This acid is commonly made uſe of in the bleaching of linen, for diſſolving and extracting the earthy particles left in the cloth by the alcaline Salts and Lime employed for cleanſing and whitening it. Butter-milk is prefered to plain Sour-milk or Sour-whey: The laſt is ſuppoſed to give the cloth a yellow colour . . . Dr. Home, [illegible] his ingenious treatiſe on this ſubject, recommends water acidulated [illegible] pure Spirit of Vitriol (in the proportion of about half an ounce, or [illegible] three quarters of an ounce to a gallon) as preferable in many reſpects to the acid of Milk, or of the more directly vegetable ſubſtances. He obſerves that the latter are often difficultly procurable, abound with oleaginous particles, and haſten to corruption; whilſt the vitriolic acid is cheap, and pure, and indiſpoſed to putrefy: That milk takes five days to perform its office, whilſt the vitriolic acid does it in as many hours, perhaps in as many minutes: That this acid contributes alſo to whiten the cloth, and does not make it weaker though the cloth be kept in it for months. He finds that acids as well as alcalies extract an oily matter from the cloth, and loſe their acidity and alcalicity.

Uſes of Milk.

The dietetic uſes of Milk and its products are well known. Milk itſelf is one of the moſt nutritious and

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(s) Milk—thick, tenacious.] New Cows-milk, ſuffered to ſtand for ſome days on the leaves of Butterwort (Pinguicula) or Sun-dew, becomes uniformly thick, ſlippery, and coherent, and of an agreeable ſweet taſte, without any ſeparation of its parts. Freſh Milk, added to this, is thickened in the ſame manner, and this ſucceſſively. In ſome parts of Sweden, as we are informed in the Swediſh Memoirs, Milk is thus prepared for food.

New milk has a degree of glutinous quality, ſo as to be uſed for joining broken ſtone-ware. There is a far greater tenacity in cheeſe properly prepared.

Sweet cheeſe, ſhaved thin, and ſtirred with boiling hot water, changes into a tenacious ſlime, which does not mingle with the liquor. Worked with freſh parcels of hot water, and then mixed, upon a hot ſtone, with a proper quantity of unſlaked Lime, into the conſiſtence of a paſte, it proves a ſtrong and durable cement for wood, ſtone, earthen-ware and glaſs. When thoroughly dry, which it will be in two or three days, it is not in the leaſt acted upon by water. Cheeſe barely beat with Quicklime, as directed by ſome of the chemiſts for luting cracked glaſſes, is not near ſo tenacious.

Cheeſe, prepared as above, is recommended in the Swediſh Memoirs to be uſed by anglers as a bait. It may be made into any form, is not ſoftened by the water; and is liked by the fiſhes.

Further experiments on Milk.] Examined by a microſcope, it appears compoſed of numerous globules ſwimming in a tranſparent fluid.

It boils in nearly the ſame degree of heat with common water; ſome ſorts rather ſooner, and ſome a little later: after boiling, it is leſs diſpoſed to grow ſour than in its natural ſtate.

It is coagulated by acids both mineral and vegetable, and by alcalies both fixed and volatile: The coagulum made by acids falls to the bottom of the ſerum, that made by alcalies ſwims on the ſurface, commonly forming, eſpecially with volatile alcalies, a thick coriaceous ſkin: The ſerum, with alcalies, proves green or ſanious; with acids, it differs little in appearance from the Whey that ſeparates ſpontaneouſly. The coagulum formed by acids is diſſolved by alcalies, and that formed by alcalies is rediſſolved by acids; but the Milk does not in either caſe reſume its original properties.

[illegible] is coagulated by most of the middle Salts, whoſe baſis is an earth [illegible] metallic body, as ſolution of Alum, fixed Sal ammoniac, Sugar of [illegible] green and blue Vitriol: but not by the Chalybeate or purging [illegible] waters, nor by the bitter Salt extracted from the purging [illegible]

Among the neutral Salts that have been tried, there is not one that produces any coagulation. They all dilute the Milk, and make it leſs diſpoſed to coagulate with acids or alcalies: Nitre ſeems to have this effect in a greater degree than the other neutral Salts.

It is inſtantly coagulated by highly rectified Spirit of Wine, but ſcarcely by a phlegmatic ſpirit.

It does not mingle with expreſſed Oils.

All the coagula are diſſolved by Gall.

ſalu-

Milk.

ſalubrious aliments. Cheeſe is a ſtrong food, hard of digeſtion. Butter ſoftens and relaxes, obtunds acrimony, and if taken liberally blunts the activity of the gaſtric liquor, and weakens the digeſtive powers; Binetus calls it "Gold in the morning, Silver at noon, and Lead at night." Where poiſonous ſubſtances, as Arſenic, have been ſwallowed, Milk and Butter, taken immediately and in large quantity are the beſt remedies for obtunding their force.

SECT. XIII.

ANIMAL EXCREMENTS.

Urine.

Its remarkable products.

THE ſaline Lixivium, ſecreted from the blood in the kidneys and thence conveyed into the bladder, is a liquor of a very ſingular kind. that human Urine ſhould participate of the common alimentary Salt, is not extraordinary; but the Urine of brutes who feed on mere vegetables, contains the ſame marine Salt:* Whence does it proceed, or from what principle is it produced!

Urine contains alſo a peculiar ſaline ſubſtance, nowhere diſcovered but in Urine itſelf, ſeparable in a cryſtalline form, eaſily fuſible on a burning coal, and running into a round drop like melted Glaſs (*t*). Diſtilled

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(*t*) *Peculiar Salt from Urine.*] This Salt called by the chemiſts the *native, eſſential*, or fuſible Salt of Urine, or the *Microcoſmic Salt*, is moſt commodiouſly prepared, by putrefying a large quantity of Urine, and then ſlowly evaporating it to the conſiſtence of a thin Syrup; which being ſet in a cold place will yield, in three or four weeks, foul brown-coloured cryſtals, containing the microcoſmic Salt, mixed with the marine or other Salts of the Urine. Theſe cryſtals are to be diſſolved in hot-water, the ſolution filtered whilſt it continues hot, and ſet to cryſtallize again, and the ſolution, filtration and cryſtallization repeated, till the Salt becomes pure and white: In all the cryſtallizations the microcoſmic Salt ſhoots firſt, and is eaſily diſtinguiſhed and ſeparated from the others. If the Urine which remains after the firſt cryſtallization, be further evaporated and ſet in the cold, it will yield more cryſtals, but browner and more impure than the former, and which are therefore to be purified by themſelves. From twenty gallons of Urine may be obtained about four ounces of pure Salt; a conſiderable part is ſtill left in the thick reſiduum.

ſtilled by a ſtrong fire, it yields not only the volatile Salt and Spirit, and empyreumatic Oil, common in the

URINE.

In all theſe operations, the heat ſhould be moderate, and the veſſels either of glaſs or compact ſtone ware. The microcoſmic Salt is a neutral ammoniacal one, compoſed of a peculiar acid united with a volatile Alcali: All other ammoniacal Salts ſublime entire on applying heat; but this ſingular Salt parts only with its Alcali, the acid remaining fixed, and incapable of concreting, by itſelf, into a cryſtalline form. Having once evaporated the putrefied Urine by a boiling heat in a copper veſſel, I obtained only a green ſolution of the Copper in the microcoſmic acid: from which I could never afterwards recover the ammoniacal Salt ſought for.

The pure microcoſmic Salt impreſſes on the tongue a ſenſe of coolneſs. It neither deliquiates in a moiſt air, nor becomes powdery in a dry and warm one. Laid upon a burning coal, it does not decrepitate like common Salt, but bubbles and melts like Borax, and runs into a colourleſs pellucid ſubſtance reſembling fine Glaſs: This apparent glaſs diſſolves eaſily in water, and proves on all trials notably acid; ſaturated with volatile Alcali, it cryſtalizes into microcoſmic Salt again. On mixing either the neutral Salt, or the vitreous acid with inflammable ſubſtances, and diſtilling the mixture with a ſtrong fire, a phoſphorus ariſes, ſimilar to that obtained directly from inſpiſſated Urine.

We are obliged to the induſtry of Mr. Marggraf for a more particular examination of this very extraordinary Salt. The ſubſtance of his experiments, communicated in the Berlin Memoirs for the year 1746, is as follows.

Sixteen ounces of the Salt, diſtilled in a glaſs retort, in a ſand-heat gradually raiſed, gave over eight ounces of a volatile urinous ſpirit, reſembling that made from Sal ammoniac by Quick-lime. The reſiduum was a porous brittle maſs, weighing eight ounces: This, urged with a ſtronger fire in a crucible, bubbled and frothed much, and at length ſunk down into the appearance of Glaſs, without ſeeming to ſuffer any further diminution of its weight in the moſt vehement heat.

The vitreous matter diſſolved in twice or thrice its quantity of water, into a clear tranſparent acid liquor, ſomewhat thick, not ill reſembling in conſiſtence concentrated Oil of Vitriol. This liquor, totally corroded Zinc into a white powder, which being diluted with water, appeared in great part to diſſolve, fixed alcalies occaſioning a plentiful precipitation. It acted powerfully upon Iron, with ſome effervescence, and changed the metal into a kind of muddy ſubſtance, inclining to bluiſh, in part ſoluble in water like the preceding. It diſſolved likewiſe a portion of Regulus of antimony, and extracted a red tincture from Cobalt. On Lead and Tin it had very little action: Copper it corroded but ſlightly: On Biſmuth, Silver, and Gold, it had no effect at all, either by ſtrong digeſtion or a boiling heat. Nor did the addition of a conſiderable portion of nitrous acid enable it to act upon Gold.

The vitreous Salt in its dry form, melted with metallic bodies by a ſtrong fire, acts upon them more powerfully. In each of the following experiments, two drams of the Salt were taken to two ſcruples of the metal reduced into ſmall parts. (1.) Gold communicated a purple colour to the vitreous Salt; on weighing the metal, however, its diminution was not conſiderable. (2.) Silver loſt four grains, or one tenth, and rendered the Salt yellowiſh, and moderately opake. (3.) Copper loſt only two grains, or one twentieth, though the Salt was tinged of a deep

URINE. the animal kingdom, but a peculiar luminous and highly inflammable concrete called Phoſphorus of Urine.

There

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deep green colour. It ſeemed as if a portion of the Salt had been retained, by the metal, which after the fuſion was found to be whiter and more brittle than before. (4.) During the fuſion with Iron, flaſhes like lightning were continually thrown out, a phoſphorus being generated from the combination of the acid of the Salt with the inflammable principle of the Iron. Great part of the mixture riſes up in froth, which when cold appears a vitreous ſcoria, covered on the ſurface with a kind of metallic ſkin, which on being rubbed changes its green colour to a yellowiſh. The reſt of the Iron remains at the bottom of the crucible, half melted, half vitrified. and ſpongy. (5.) Tin loſt eighteen grains, or near one half its weight, and rendered the Salt whitiſh: the remaining metal, being at the ſame time remarkably changed. It was all over leafy and brilliant, very brittle, internally like Zinc: Laid on burning coals, it firſt begun to melt, and then burnt like Zinc or Phoſphorus. (6.) Lead loſt ſixteen grains, and gave the ſame whitiſh colour to the ſcoriæ that Tin does. The remaining Lead was in like mannner inflammable, but burnt leſs vehemently than the Tin; from which it differed alſo in retaining its malleability. (7.) Mercury precipitated from Aqua fortis and well edulcorated, being treated with the Salt in a glaſs retort with a fire raiſed to the utmoſt, only twelve grains of Mercury ſublimed, twenty-eight remaining united with the Salt into a whitiſh ſemi-opake maſs. A ſolution of this mixt in diſtilled water depoſited a quantity of a yellowiſh powder, which by diſtillation in a glaſs retort was in great part revived into running Mercury: A part of the Quickſilver remained diſſolved alſo in the clear liquor; for a drop, let fall on poliſhed copper, inſtantly whitened it. (8.) Regulus of Antimony melted with the vitreous Salt, loſt eight or nine grains, (about one fifth): The Regulus aſſumed a fine brilliant ſtriated appearance; the ſcoriæ were ſomewhat opake. (9.) Biſmuth loſt eight eight grains: The ſcoriæ were like the preceding, but the Biſmuth itſelf ſuffered little change. (10.) Zinc mixed with the Salt, and diſtilled in a glaſs retort, yielded a true Phoſphorus, which aroſe in a very moderate heat. The reſiduum was of a grey colour, a litttle melted at the bottom, in weight not exceeding two drams, ſo that two ſcruples had ſublimed. This reſiduum, urged further, in a ſmall Heſſian crucible, to perfect fuſion, emitted an infinity of phoſphorine flaſhes, with a kind of detonation: The matter, grown cold, looked like the grey ſcoriæ which ariſe in the fuſion of common Glaſs. (11.) White Arſenic, mixed with this Salt, ſeparated in the fire, greateſt part of it ſubliming, and only ſo much remaining behind as increaſed the weight of the Salt eight or ten grains. This compound appeared at firſt tranſparent, but on being expoſed to the air became moiſt, and of an opake whiteneſs, much reſembling cryſtalline Arſenic. (12.) Cinnabar totally ſublimed, ſuffering no change itſelf, and occaſioning none in the Salt. Sulphur did the ſame. (13.) One part of the Salt mixed with ten of Mangancſe, and melted in a cloſe veſſel, gave a ſemitranſparent maſs, ſome parts of which were bluiſh. The crucible was lined with a fine purple glazing, and the edges of the maſs itſelf appeared of the ſame colour:

The vitreous Salt diſſolved alſo, in fuſion, metallic calces and earths. Chalk, with one third its weight of the Salt, formed a ſemitranſparent

vitreous

There are conſiderable differences in Urine, from the ſeaſon, aliments, or temperature of the body. It is

URINE.
Its differences.

vitreous maſs: Calcined marble, with the ſame proportion, flowed ſo thin as to run all through the crucible; Gypſum likewiſe run moſtly through the crucible; what remained was ſemitranſparent: Lapis Specularis (*Marien-glas*) run entirely through the veſſel: Spaniſh Chalk gave a ſemi-tranſparent maſs, which ſparkled on breaking; and fine white Clay, a ſimilar one: Saxon Topaz and Flint were changed into beautiful opal-coloured maſſes; the earth of Alum into a ſemitranſparent, and Quick-lime into an opake white one. The maſs with Flints imbibed moiſture from the air; the others not.

Oil of Vitriol, poured upon one fourth its weight of this Salt in a retort, raiſed an effervеſcence, acquired a browniſh colour, and afterwards became turbid and white. On raiſing the fire, the Oil of Vitriol diſtilled and the matter in the bottom of the retort melted. In the neck was found a little Sublimate, which grew moiſt in the air; as did likewiſe the remaining Salt, which was opake and whitiſh---Concentrated ſpirit of Nitre, diſtilled with this Salt in the above proportion, came over unchanged; no Sublimate appeared; the reſiduum looked like Glaſs of Borax. The diſtilled ſpirit did not act in the leaſt upon Gold even by coction---Strong Spirit of Sea-ſalt being diſtilled in the ſame manner, no ſenſible change was made either in the Spirit or the Salt.

Equal parts of the vitrified microcoſmic Salt and of Salt of Tartar being urged with the ſtrongeſt fire that a Glaſs retort would bear, nothing ſenſible came over, nor did the mixture appear in thin fuſion. Diſſolved in water, filtered and ſuitably evaporated, it afforded, very difficultly, oblong cryſtals, ſomewhat alcaline, the quantity of alcali having been more than enough to ſaturate the microcoſmic acid. A whitiſh matter remained on the filter, amounting to ſeven or eight grains from two drams of the mixture: This, after being waſhed and dried, melted before a blow-pipe; as did likewiſe the cryſtals.

This Salt ſeems to extricate in part the acids of vitriolated Tartar, Nitre, and Sea ſalt. (1.) On diſtilling a mixture of it with an equal quantity of vitriolated Tartar, there came over ſome ponderous acid drops, which ſaturated with fixed Alcali, formed a neutral Salt greatly reſembling the vitriolated Salt. The reſiduum readily diſſolved in water, and difficultly cryſtallized. (2.) Nitre treated with the ſame proportion of the Salt begun to emit red vapours. The reſiduum was of a peach bloſſom colour, appeared to have melted leſs perfectly than the preceding, and diſſolved more difficultly in water. The ſolution depoſited a little earthy matter, and on being ſlowly evaporated, ſhot into cryſtals, which did not deflagrate in the fire. (3.) Sea-ſalt diſtilled in the ſame manner, manifeſtly parted with its acid. The reſiduum was whitiſh, readily diſſolved in water, and afforded ſome cubical cryſtals. (4.) Sal ammoniac ſuffered no change. Borax, with an equal quantity of the vitreous Salt, run all through the crucible.

Solutions of this Salt precipitated the earthy part of Lime-water, of ſolution of Alum, of Flint diſſolved in fixed Alcali, and the *liquamen ſalis ammoniaci fixi*, or concentrated ſolution of Chalk or Quick-lime in the marine acid. The Precipitate obtained from this laſt liquor is tenacious like Glue, and does not diſſolve even in boiling water: Expoſed to a ſtrong fire, it froths prodigiouſly, and at laſt melts into a thick ſcoria.

Urine.

is generally paler and more dilute in winter than in ſummer, and in young perſons than adults. By diſeaſes, it is ſo much influenced, than in many caſes the appearance of the Urine is an uſeful aſſiſtance to the phyſician in forming a judgment of the diſtemper. Such as is voided in the morning, or many hours after eating or drinking, is for obvious reaſons the moſt ſaturated.

How far its quaility is affected by particular aliments or liquors, is not clear: There are ſubſtances which communicate to it a manifeſt impregnation; thus Aſparagus gives a ferid ſmell, and Turpentine a violet one; Rhubarb and Turmerick a deep yellow colour, and the pulp of Caſia fiſtularis, a greeniſh or blackiſh one: But that the drinking of Wine or

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Soluitons of this Salt precipitate alſo ſundry metallic ſolutions, as Butter of Antimony; ſolutions of Silver, Copper, Lead, Iron, Mercury, and Biſmuth, in the nitrous acid; and of Tin in Aqua regis. The Precipitate of Iron from Spirit of Salt is a tenacious maſs: That of Silver from Aqua fortis, ſometimes a white powder, ſometimes tenacious: Copper from Aqua fortis is ſometimes thrown down in form of a white powder, and ſometimes in that of a green Oil, according to the proportions and diluteneſs of the liquor. Silver is not precipitated at all by this acid from its ſolution in Vinegar, nor Gold from Aqua regis.

An ounce of the vitreous Salt well mixed with half an ounce of Soot, and committed to diſtillation, yielded a dram of fine Phoſphorus: The black reſiduum being elixated with boiling water, and the liquor paſſed through a filter; there remained upon the filter eight ſcruples of black matter, and on evaporating and cryſtallizing the liquor, about ſeven drams were obtained of oblong cryſtals, which did not deliquiate in a moiſt air; but became powdery in a warm one. Theſe cryſtals, treated afreſh with inflammable matter, yielded no Phoſphorus. Before a blow pipe, they melted into a tranſparent globolar maſs, which on cooling became turbid and opake. Diſſolved in water, they precipitated ſolutions of Silver, Mercury, Copper, and of Chalk, though they did not act upon the latter ſo powerfully, nor produce with it a gluey maſs, as before they had been deprived of their phoſphorine acid.

The author from whom we have taken theſe curious experiments ſuppoſes that the origin of the microcoſmic Salt is in the vegetable kingdom; that it actually exiſts, all but its volatile alcaline ſalt, in ſundry vegetable ſubſtances, and is thence communicated to the Urine of animals. He finds that the ſeeds of Rocket, Creſſes, Muſtard, and even Corn, on being urged with a vehement fire, afford a true Phoſphorus, and of conſequence muſt contain the phoſphorine acid: And that human Urine yields more of the microcoſmic Salt in Summer, when vegetable foods are uſed moſt freely, than in winter. This difference, however, may depend not upon the difference of food, but upon the Urine being more dilute in one ſeaſon than in the other.

Beer

Beer occaſion any remarkable difference, as the antients ſuppoſed, there is little ground to preſume.

Its nature, Recent perfect Urine is not ſenſibly alcaline or acid; but in keeping, it ſoon begins to putrefy and acquire an alcaline quality; and this change it ſometimes undergoes before its diſcharge from the body. By putrefaction, its marine Salt is in part deſtroyed or volatilized; and hence after diſtilling putrefied Urine, we obtain from the Caput mortuum much leſs of that Salt than when freſh Urine is uſed, and this in proportion as the putrefaction has been carried to a greater or leſs length.

and uſes. Urine is made uſe of in ſundry chemical arts; as in dying, ſcouring, making Alum, Sal ammoniac, Nitre, &c. It has ſometimes been employed in the ſhops as a precipitant for certain ſolutions: A *Lac* or white Precipitate is thrown down by it from a ſolution of Sulphur made by boiling Sulphur in water along with Quick-lime; and a roſe-coloured Precipitate, from a ſolution of Quick-ſilver in the nitrous acid.

Diſtillation of Urine. The volatile ſpirit and Salt of Urine are uſually prepared, by putrefying the Urine in large wooden tubs; and then diſtilling it with a gentle heat gradually increaſed. If the fire is raiſed a little too haſtily, it ſwells up and boils over: This inconvenience may be prevented by rubbing the upper part of the veſſel all round with Tallow.

Some dephlegmate the putrefied Urine in open veſſels, and then proceed to the diſtillation of the remaining thick matter; but in this proceſs, a good deal of the ſubtile ſpirit is loſt. The Urine may however be advantageouſly dephlegmated before putrefaction, either by fire, or what is ſtill more commodious where the ſeaſon will permit, by freezing; for only the aqueous parts congeal, and by the ſeparation of theſe, the remainder becomes proportionably more ſaturated.

By adding Quick-lime to the inſpiſſated Urine a cauſtic volatile ſpirit is obtained, without putrefaction,

URINE.

tion, ſimilar to that prepared by the ſame intermedium from Sal ammoniac: By this addition, the volatile ſpirit is extricated without the application of any external heat; the inſpiſſated Urine growing hot when mixed with the Quick-lime, and this heat being ſufficient to elevate a conſiderable part of the volatile penetrating ſpirit.

The rectification of the Spirit, Salt, and Oil of Urine, is performed in the ſame manner as of thoſe of other animal ſubſtances. I have had an Oil of Urine, which taſted as ſweet as Sugar. From the Caput mortuum is obtained, by elixation with water, the Sea-ſalt; and by calcining and then elixating it, a fixed alcaline one. I have prepared from this ſubject two fixed alcalies, differing from one another; one groſſer, and the other more ſubtile. The marine Salt alſo is more ſubtile than common Sea-ſalt: On diſtilling the entire Caput mortuum with the addition of ſuch ſubſtances as extricate the acid of Sea-ſalt, there ariſes an acid ſpirit, ſimilar in its general properties to the marine, but in ſome reſpects different from it.

Phoſphorus: Its hiſtory.

THE Phoſphorus of Urine, called emphatically Phoſphorus, by ſome *Phoſphorus urens, phoſphorus glacialis, noctiluca glacialis, noctiluca aerea*, was caſually diſcovered, about the year 1669, by one Krafft, a German chemiſt. Soon after, Kunckel prepared it; and one Brand, having procured ſome pieces, though unacquainted with the method of making it, went into England, France, *&c.* and arrogated to himſelf the honour of the diſcovery. At length Mr. Boyle and Mr. Homberg found out the ſecret; and Godfrey Hanckwitz, then operator to Boyle, improved, refined, and perfected the Phoſphorus.

Preparation.

The Phoſphorus is obtained by diſtilling in a ſtrong fire either inſpiſſated Urine, or the Caput mortuum remaining after its diſtillation in the common manner. Some additional matters are generally mixed with the inſpiſſated Urine; Homberg uſes red Bole; Boyle, white Sand; and Boerhaave, powdered Charcoal. An account of the manner of conducting the proceſs may be ſeen in the Memoirs of the French Academy and other books. If we have a good furnace, and a retort that will ſtand a fierce fire, there is no difficulty in obtaining the Phoſphorus in ſmall grains, like Millet-ſeed or Lentils: But in preparing it into fine large white ſticks, like pieces of tobacco-pipes, no one has hitherto ſucceeded like Mr. Godfrey. It congeals, at the bottom of the recipient, like the ice of dirty water in kennels, and requires a further purification from its brown and blackiſh matter (u).

A good

(u) *Proceſs for Phoſphorus.*] Mr. Hellot, in the Memoirs of the French Academy for the year 1737, has given a very particular account of the moſt ſucceſsful manner of conducting this operation. If his directions are carefully followed, it will be impoſſible, he ſays, to miſcarry.

A large quantity of Urine, after ſtanding to putrefy for at leaſt five or ſix days, is to be evaporated in an iron kettle, till the matter grows thick and black: It is then to be kept conſtantly ſtirring, to prevent its forming a hard incruſtation upon the veſſel, till it is reduced into a ſhining black, clotty, powdery ſubſtance, like Soot.

This dry reſiduum is to be calcined in an iron pot, by five or ſix pounds at a time, with a fire ſufficient to make the veſſel red-hot. The calcination is to be continued, and the matter kept ſtirring, till it has loſt almoſt all its volatile Salt and fetid Oil, that is, till it ceaſes to ſmoke, and acquires a ſmell like that of Peach bloſſoms.

The calcined matter is to be freed from the ſuperfluous marine Salt of the Urine (which ſeparating and melting in the diſtillation, would corrode the retort) by elixation with water. To every pound, put a pint and a quarter of water; ſtir them together, and let them ſtand for twenty-four hours; then decant off the ſaline liquor, and dry the remaining powder.

Sixty gallons of Urine leave on evaporation about ten pounds of dry matter. This loſes in the calcination about one third its weight, and in the elixation about one half of the remainder; and thus is reduced to three pounds or three and a half; a quantity ſufficient for one diſtillation, and which will yield an ounce or more of Phoſphorus.

Three pounds of the elixated powder are to be mixed with a pound and a half of coarſe Sand, and four or five ounces of powdered Charcoal. The Sand ſhould not be that of rivers, for this crackles and flies about when ſtrongly heated; nor the Charcoal that of Oak, which is accompanied with the ſame inconvenience. The mixture is to be moiſtened with about half a pound of water, and made into a maſs, to be put into a Heſſian retort of ſuch a ſize that one third of it may remain empty. The common earthen-retorts or long-necks are incapable of ſtanding the intenſe fire requiſite for this operation.

Before we proceed to the diſtillation, it will be proper, for the greater ſatisfaction and ſecurity, to make an aſſay of about an ounce of the mixture in a ſmall crucible made gradually red hot. If it has been duly prepared, it will ſmoke and crack, without ſwelling or riſing up: White or bluiſh undulating flames will ariſe impetuouſly from the cracks: On placing upon the crucible, when theſe diſappear, a large piece of lighted

URINE.

A good deal of caution is requiſite in all operations with this inflammable concrete: Mr. Godfrey himſelf,

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Charcoal, the true Phoſphorus will diſcover itſelf in a ſteady, luminous, ſomewhat violet-coloured vapour, covering the whole ſurface, and ſmelling ſtrongly of Garlic. When this vapour is diſſipated, pour the hot matter upon an iron plate: If no particle of Salt can be ſeen in it, we have nothing to fear; but if any drop of Salt has melted out and appears diſtinct, the elixation with water muſt be repeated or the retort will be in danger.

The retort, charged with the mixture, is to be placed in a reverberatory furnace, ſo conſtructed as to be capable of giving as fierce a heat as that of the glaſs-houſe furnaces. Adapt to the retort a large glaſs receiver filled to one third with water; and ſecure the juncture with a mixture of tobacco-pipe Clay and drying Oil, over which is to be ſpread ſome common lute moiſtened with a ſolution of Glue.

It is indiſpenſably neceſſary that the juncture be perfectly tight; but it is equally neceſſary that an exit be allowed to the elaſtic vapours, which otherwiſe would infallibly burſt the veſſels. If we endeavour to give them vent by an upright tube inſerted in the luting, as is cuſtomary in other operations, the heat of this part of the veſſel would fire the ſubtile phoſphorine vapours that ariſe firſt, and theſe would kindle the true Phoſphorus which ſucceeds. An aperture is therefore to be made in the further part of the receiver itſelf, about four or five inches above the ſurface of the water: This is the grand ſecret in the whole proceſs. It will be eaſy to contrive means of grinding a ſmall hole through the glaſs with Emery; which hole is to be fitted with a little birchen plug furniſhed with a knob to keep it from ſlipping in.

The apparatus having ſtood for three or four days, till the luting is dry; and the cracks, if any have happened, being repaired; proceed to the diſtillation. This laſts commonly four and twenty hours. Mr. Hellot begins at two in the morning, by putting an unlighted coal into the aſh-hole, and a lighted one at the door, which kindles the other. By gradually ſupplying a little more fuel in the aſh-hole, the furnace and luting become thoroughly dry, and the phlegm of the mixture diſtils. At ſix, ſome coals are laid on the grate; which being ſoon kindled by the fire underneath, the receiver grows warm, and is filled with white fetid vapours. At ten, theſe vapours diſappear, the receiver grows cool, and the fire is to be increaſed and ſteadily kept up. About noon, a ſaline ſubſtance, different from the common volatile Salt of Urine, begins to concrete in elegant ramifications all over the internal ſurface of the recipient, and is by degrees diſſolved and waſhed down by the ſteam of the water in that veſſel. About three after noon, the receiver is filled with freſh vapours, which ſmell like Sal ammoniac thrown on burning coals, and which condenſe into ſaline ſtriæ not diſſoluble by the ſteam of the water. Theſe are the forerunners of the Phoſphorus, and towards the end of their diſtillation they loſe the ammoniacal and acquire a phoſphorine or Garlic ſmell. As they come over with great rapidity, the aperture in the receiver muſt now be frequently unſtopt; and if the vapour hiſſes forth impetuouſly, the heat muſt be diminiſhed by cloſing up the air-draughts of the furnace. Theſe white vapours continue about two hours; after which the fire is to be raiſed, and kept up moderately ſtrong. About ſix, the more volatile phoſphorine fumes beginning to himſelf, notwithſtanding his large experience, was once in danger of his life from it, his hand being burnt ſo

ariſe, the birchen peg rubbed upon any warm part of the furnace leaves a luminous tract; and ſoon after, there darts through the aperture in the receiver a ſtream of bluiſh light, which does not burn, but renders the hands luminous. On unſtopping the aperture from time to time, the luminous ſtream is obſerved gradually to lengthen to ſeven or eight inches; and afterwards to grow ſhorter, to crackle, ſparkle and burn. In about two hours from the firſt appearance of this volatile Phoſphorus, the ſmall jet of light contracts to the length of one or two twelfths of an inch: There is now no danger of the veſſel's burſting; puſh the fire boldly to the utmoſt extremity, and for ſix or ſeven hours keep up ſuch a white heat, that the retort cannot be diſtinguiſhed. In this extreme degree of heat, the true Phoſphorus comes over, in the form of Oil or melted Wax, partly ſwimming upon the water in the receiver, and partly ſinking to the bottom. At length the upper part of the recipient, where the volatile Phoſphorus had condenſed into a back film, begins to grow red; a mark that the Phoſphorus is there burnt, and that the operation is finiſhed. The furnace is now to be ſhut up cloſe, and the aperture in the receiver ſtopt up with Fat, Lute, or melted Wax. All the empty part of the receiver appears luminous till the veſſels are grown cold.

When the whole is become thoroughly cold (not before, leſt the Phoſphorus ſhould take fire) ſeparate the receiver, and expeditiouſly wipe out the black matter about its mouth, which mingling with the Phoſphorus would injure its tranſparency. A quantity of cold water is to be poured into the receiver, to waſh out and promote the ſettling of the Phoſphorus; and the whole poured into a clean earthen pan. The cold water being decanted off, ſome boiling water is to be added to melt the Phoſphorus, which now forms a maſs of a ſlate colour, to be broke in pieces, when cold, in freſh cold water.

The Phoſphorus is purified and formed into ſticks, by melting it in boiling water in glaſs tubes. The neck of a matraſs, having its mouth or lower aperture ſtopt with a cork and greateſt part of its body cut off, forms a convenient veſſel for this purpoſe. The tube being filled with the boiling liquor, throw in the pieces of Phoſphorus, which ſoon liqueſy and ſink to the bottom: Stir the liquid matter with an iron wire, to promote the ſeparation of the impurities, and keep the water boiling till, on taking out the tube, the Phoſphorus appears clear and tranſparent. The tube being then cooled a little in the air is to be plunged in cold water, to make the Phoſphorus congeal. The ſtick is to be puſhed out at the wider end of the tube, and the impure part at top cut off.

Mr. Hellot ſays, that from three pounds and a half of the calcined and elixated matter he obtained ſix ſticks of Phoſphorus, each four inches long, weighing in all nine drams and ſome grains, at leaſt equal in quality to that made by Mr. Godfrey; and that he was informed that Mr. Godfrey uſed a receiver with a vent-hole, and inſtead of inſpiſſated Urine the ſettlings procured from the dyers. In caſe of accidents from the Phoſphorus taking fire, he finds nothing to extinguiſh it but Urine.

THERE is one ſtep in this proceſs, which requires further examination and which, ſo far as I can judge from the experiments that have as yet been made, is rather prejudicial than uſeful. We have formerly ſeen that Urine contains a certain fixed acid Salt, of a peculiar kind; and that

URINE. ſo terribly, that for a time he was out of his ſenſes, and for three days lay in exquiſite pain, as if his hand had been conſtantly in a fire.

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the Phoſphorus conſiſts of this acid combined with inflammable matter. Now as this Salt diſſolves eaſily in water, it ſhould ſeem that the elixation of the calcined Urine could not fail to ſeparate a great part of this eſſential ingredient, as well as the marine Salt of the Urine; and in effect, the ſaline liquor diſcovers, upon trial, plain marks of the microcoſmic or phoſphorine Salt.

More than double the above quantity of Phoſphorus has been obtained, in leſs time and with leſs fire, by *adding* certain ſaline ſubſtances to the inſpiſſated Urine, inſtead of *ſeparating* any of its native Salts. This diſcovery was firſt made by Henckel, in treating calx of Lead with Sal ammoniac, Salt of Tartar, and ſtale Urine, in a view to the reſolution or mercurification of the metal. Mr. Marggraf has re-examined and proſecuted the experiment, and found *ſaturnus corneus*, or a combination of Lead with the marine acid, to be the beſt addition.

Saturnus corneus is moſt commodiouſly prepared by mixing Sal ammoniac with twice its weight of Minium, and expoſing them to a moderate heat: The volatile Alcali of the Sal ammoniac is extricated, and its marine acid remains combined with the ſaturnine calx into a brittle reddiſh maſs.

Nine or ten pounds of inſpiſſated Urine, about the conſiſtence of thin Honey, were ſet to evaporate further in an iron pot: three pounds of the above Saturnus corneus in powder, and half a pound of powdered Charcoal, gradually mixed in; and the whole kept ſtirring, till reduced into a dry blackiſh powder. This, urged with a red heat, gave over a ſmall portion of urinous ſpirit and an ammoniacal Sublimate; after which it was pulverized afreſh, in order to the more perfect mixture of the ingredients. A little of it, being examined on burning coals, gave inſtantly an arſenical or phoſphorine ſmell, and an undulating blue flame.

With the powder thus prepared, were charged, to three fourths of their capacity, ſix earthen pint retorts; the fire acting to better advantage upon a number of ſmall veſſels, than on a large one equivalent to them. To each retort was luted a glaſs receiver, ſomewhat more than half filled with a pint of water, which was made almoſt to touch the end of the neck of the retort. The fire being gradually raiſed, and kept up ſtrong for an hour and a half, the Phoſphorus came over in drops which being collected and purified, amounted in all to two ounces and a half of as fine Phoſphorus as can be made. The whole continuance of the diſtillation was but four hours and a half.

Luna cornea had much the ſame effect as Saturnus corneus. With Calamine alſo the quantity of Phoſphorus was larger than the Urine by itſelf would have afforded.

THE acid of Phoſphorus agrees in ſome of its properties with the marine acid, and is ſuppoſed by the chemiſts to be at bottom no other than the marine, altered a little by the admixture of ſome other matter.

As the vitriolic acid forms with inflammable matter common Sulphur, and the nitrous a compound which deflagrates in the cloſeſt veſſels the very inſtant it is formed; ſo the marine is held to produce, with the ſame inflammable principle, this ſingular ſpecies of Sulphur, more inflammable than the one, and leſs ſo than the other.

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This Phoſphorus is ſet on fire by rubbing as well as by the application of actual heat; and burns far more vehemently, and with a more piercing heat, than any other known ſubſtance. Expoſed to a temperate air, it appears luminous like a burning coal, and emits a continual offenſive ſmoke, till the whole quantity is diſſipated. Characters drawn with it on paper or other ſubſtances, appear alſo, in the dark, as if they were on fire. It is very ſlowly conſumed; a ſingle grain diffuſing a ſeemingly burning light for fifty hours together.

URINE. and properties.

Though this concrete takes fire ſo readily when rubbed by itſelf, it does not fire at all by grinding it with other inflammable bodies, as Camphor, Gunpowder, or eſſential Oils. In grinding it with Nitre, ſome luminous flaſhes are obſerved, but the mixture never burns, unleſs the quantity of Phoſphorus be large in proportion to the Nitre. Rubbed pretty hard on a piece of Paper or Linen, it ſets them on fire if they are rough, but not if they are ſmooth: It fires written Paper more readily than ſuch as is white, probably from the former having more aſperities. On grinding it with iron filings it preſently takes fire.

Oils, ground with Phoſphorus, appear like itſelf luminous in a temperately warm place, and thus become a liquid Phoſphorus, which may be rubbed on the hands, *&c.* without danger. Liquid Phoſphorus is commonly prepared, by grinding a little of the ſolid Phoſphorus with Oil of Cloves, or rubbing it firſt with Camphor, and this mixture with the Oil. A luminous Pomatum is obtained in the ſame manner, by uſing common Pomatum inſtead of the diſtilled

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This theory, firſt advanced by Stahl, is countenanced by the phoſphorine flame which ariſes from common Salt thrown on burning coals. Hence trials have been made for procuring Phoſphorus without Urine, from common Salt or its acid and vegetable or animal inflammable matters; but hitherto without ſucceſs. And indeed the acid ſeparated from Phoſphorus, as we ſhall ſee hereafter, is in many of its properties extremely different from the marine, and from all other known acids or combinations of acids.

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ſtilled Oil. A luminous amalgam, as it is called, is prepared by digeſting a ſcruple of the ſolid Phoſphorus, reduced into ſmall bits, with half an ounce of Oil of Lavender; and when the Phoſphorus begins to diſſolve, and the liquor to boil, adding a dram of pure Quickſilver; then briſkly ſhaking the glaſs for five or ſix minutes, till they unite.

Rectified Spirit of Wine, digeſted on Phoſphorus, extracts a part of it, ſo as to emit luminous flaſhes on being dropt into water: It is computed that one part of Phoſphorus will communicate this property to ſix hundred thouſand parts of ſpirit: The liquor has never been obſerved to appear luminous by itſelf, nor in any other circumſtance than that above-mentioned, By digeſtion for ſome months, the undiſſolved Phoſphorus is reduced into a tranſparent Oil, which neither emits light, nor congeals in the cold: By waſhing with water, it is in ſome meaſure revived; acquiring a thicker conſiſtence, and becoming again luminous, though in a leſs degree than at firſt. The operator ought to be on his guard during the digeſtion, as the glaſs is very apt to burſt. No menſtruum is as yet known, that readily and perfectly diſſolves this concrete. Dr. Cyprianus hit once on ſuch a menſtruum, but never could ſucceed again (*x*).

With

(*x*) *Solubility, &c. of Phoſphorus.*] This concrete diſſolves partially in expreſſed Oils, and totally or almoſt ſo in eſſential Oils and Æther: When eſſential Oils are ſaturated with it by heat, a part of the Phoſphorus ſeparates on ſtanding in the cold, in a cryſtalline form.

Concentrated Spirit of Salt has no action on it; in diſtillation, the ſpirit ariſes firſt, and the Phoſphorus after it, unchanged.

Spirit of Nitre diſſolves it: The action of this acid is accompanied with great heat and copious red fumes, inſomuch that great part of the ſpirit diſtils without the application of any external heat, and the Phoſphorus at laſt takes fire, explodes, and burſts the veſſel.

Oil of Vitriol likewiſe diſſolves Phoſphorus, but not without a heat ſufficient to make the acid diſtil: The diſtilled liquor is thick, white, and turbid; the reſiduum is a whitiſh tenacious maſs, which deliquiates, but not totally, in the air. Phoſphorus itſelf is reſolved into an acid liquor on being expoſed for two or three weeks to the air, its inflammable principle ſeeming by degrees to be diſſipated.

PHOSPHORUS has been reported to produce extraordinary effects in the reſolution of metallic bodies; but from the experiments that have

been

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With regard to the compoſition of the Phoſphorus, one of its principles is apparently the concentrated inflammable ſubſtance of the animal Oil of the Urine: The other is the concentrated acid of the marine Salt of the Urine. The water, in which the Phoſphorus has been long kept, (for it is commonly kept in water to preſerve it from diſſipation,) is manifeſtly acid to the taſte, and on mixture with different ſubſtances is found to poſſeſs the general properties of acid liquors; On burning the Phoſphorus

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been made in this view, it does not appear to have any remarkable action on them, at leaſt on the precious ones Gold and Silver, for the reſolution or ſubtilization of which it has been chiefly recommended. The following experiments were made by Mr. Marggraf.

1. A ſcruple of filings of Gold was digeſted with a dram of Phoſphorus for a month, and then committed to diſtillation. Part of the Phoſphorus aroſe, and part remained above the Gold, in appearance reſembling Glaſs: This grew moiſt on the admiſſion of air, and diſſolved in water, leaving the Gold unaltered.

2. Half a dram of fine Silver precipitated by Copper being digeſted with a dram of Phoſphorus for three hours, and the fire then increaſed to diſtillation, greateſt part of the Phoſphorus aroſe pure, and the Silver remained unchanged.

3. Copper filings being treated in the ſame manner, and with the ſame quantity of Phoſphorus; the Phoſphorus ſublimed as before, but the remaining Copper was found to have loſt its metallic brightneſs, and to take fire on the contact of flame.

4. Iron filings ſuffered no change.

5. Tin filings run into granules, which appeared to be perfect Tin.

6. Filings of Lead did the ſame.

7. The red calx of Mercury, called Precipitate per ſe, treated in the ſame manner, was totally revived into running Quickſilver.

8. Regulus of Antimony ſuffered no change itſelf, but occaſioned a change in the conſiſtence of the Phoſphorus, which after being diſtilled from this ſemimetal, refuſed to congeal, and continued, under water, fluid like Oil Olive.

9. With Biſmuth, there was no alteration.

10. A dram of Phoſphorus being diſtilled and cohobated with an equal quantity of Zinc; greateſt part of the Zinc ſublimed in form of very light, pointed flowers, of a reddiſh-yellow colour: Theſe flowers, injected into a red-hot crucible, took fire, and run into a glaſs, reſembling glaſs of Borax.

11. White Arſenic, ſublimed with Phoſphorus, aroſe along with it in form of a mixed red Sublimate.

12. Sulphur unites readily with Phoſphorus, into a maſs which ſmells like Hepar ſulphuris. This does not eaſily take fire upon being rubbed; but expoſed to a moderate dry heat, it flames violently and emits a ſtrong ſulphureous fume.

ALVINE FECES.

in a Silver veſſel, a quantity of acid remains behind (y).

IT was in ſearching for alchemical ſecrets, that the Phoſphorus of Urine was diſcovered. The alchemiſts have ſearched alſo in the Alvine feces, but nothing of much importance has reſulted from the fulſome labour. Homberg obſerved that the fecal matter calcined with Alum proves a ſpecies of Phoſphorus, which takes fire on being expoſed to the air; but the ſame product is found to be equally parable from Alum and any other animal or vegetable inflammable matter. In ſome proceſſes, the human fecal matter has yielded a ſmell like that of Muſk or Civet: A tincture made from it in ſweet-ſcented waters or rather vinous ſpirits, evaporated by a gen-

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(y) *Acid of Phoſphorus.*] The properties of this extraordinary acid ſo far as they have hitherto been diſcovered, are theſe.

1. It is the moſt fixed of all acids, and is not volatilized by flame, ſince it remains after the burning of the Phoſphorus, and may be collected in notable quantity even in an open veſſel. If a veſſel is placed over the burning Phoſphorus, a quantity of light flowers concretes in it, which diſſolve in the air into an acid liquor ſimilar to that which remains in the lower veſſel.

2. On diſtilling off the phlegm of the acid liquor in glaſs veſſels, a ſolid ſaline ſubſtance remains; which on raiſing the fire melts into the appearance of Glaſs. The vitreous matter, urged with a blow-pipe on a piece of Charcoal, runs into a round bead, which rolls about like Silver in the cupel. Expoſed to the air, it ſoon grows moiſt, and by degrees runs into an acid liquor again.

3. This acid, ſaturated with pure fixed alcaline Salt, ſhoots into cryſtals; which, before a blow-pipe, do not crepitate like marine Salt, but bubble and boil like Borax, and then ſink into a pellucid vitreous bead.

4. Saturated with volatile Alcali, it ſhoots into oblong ſpicular cryſtals, which melt in nearly the ſame degree of heat that Lead does, and in a ſtronger fire part with their volatile Alcali, a ſemivitrefied ſubſtance remaining.

5. It totally diſſolves Zinc, Iron, Calx of Copper, and white Arſenic. Lead, Tin, and Copper filings, it diſſolves only partially. Silver and Gold it has no action upon at all.

6. Mixed with a ſolution of Gold, it occaſions no turbidneſs or precipitation. After the liquor has ſtood for ſome time, a little of the Gold is depoſited in its bright metallic form. Mr. Margraf relates, that upon diſtilling the mixture by a ſtrong fire, ſome obſcure yellow drops appeared; that the reſiduum was of a purple colour, and lightly covered with reduced Gold, and that before a blow-pipe it run with eaſe into an opake glaſs-like ſubſtance.

7. Silver, diſſolved in volatile Alcali, is precipitated by this acid of a yellow colour, not white as by the marine acid. The ſame metal-

ALVINE FECES.

the heat to a thick conſiſtence, is called by ſome *occidental Civet.*

The dungs of different animals have been employed in medicine; not only for external purpoſes; but likewiſe internally, in the form of infuſion, ſpirituous tincture, and ſometimes of powder. As one of theſe differs remarkably from the other ſubſtances of this claſs, I ſhall give an account of the experiments I have made upon it.

ALBUM-GRÆCUM.

Album-græcum, or the white dung of a dog that feeds upon bones, ſeems to conſiſt chiefly of the earthy part of the bones, and to have very little of a ſtercoraceous nature.

Half an ounce, digeſted with rectified Spirit of Wine, gave three grains of a blackiſh extract, which had neither ſmell nor taſte: The ſame quantity, boiled in freſh parcels of pure diſtilled water, gave twenty grains of extract, in colour blackiſh, in taſte quite ſaline, like the watery extract of bones. The remaining powders had the ſame appearance as at firſt: In diſtillation, the ſpirit aroſe unaltered; and the diſtilled water had only a very ſlight kind of unpleaſant ſmell.

Spirit of Vitriol diſſolved a little of the *Album-græcum*, and acquired from it a yellowiſh tinge; but there was no appearance of the cryſtalline concretions, which uſually ſeparate from ſolutions of other animal earthy bodies made in this acid. Spirit of Nitre diſſolved nearly the whole, and Spirit of Salt about one half; both theſe became likewiſe yellowiſh. Spirit of Sal

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diſſolved in fixt Alcali that has been impregnated with animal inflammable matter, is precipitated by the phoſphorine acid of a red colour, whilſt the marine acid makes no precipitation at all.

8. Solution of Mercury in Aqua fortis is copiouſly precipitated by the phoſphorine acid, but on ſtanding greateſt part of the Precipitate is taken up again; what remains undiſſolved is a ponderous black powder. In diſtillation, a notable quantity of white ſhining matter is left, which before a blow-pipe melts into a pellucid glaſs: On continuing the flame greateſt part of the vitreous matter ſinks into the coal and ſmokes away.

9. Solution of Lead in Aqua fortis depoſites on the addition of the phoſphorine acid a white powder, which on ſtanding is not rediſſolved. The matter which remains upon diſtilling this mixture, melts by a blow-pipe into a beautiful pellucid glaſs drop, without fumes, and without any revival of the Lead.

ALBUM GRÆCUM

ammoniac, common alcaline Ley, and cauſtic Ley, extracted alſo a yellowiſh tincture, without diſcovering any further action.

Two ounces, diſtilled in a retort, gave over two drams and a half of clear water which had no ſmell or taſte, then one dram and a half of a yellow empyreumatic liquor, and afterwards half a dram of an empyreumatic Oil of a volatile ſmell: The Caput mortuum weighed one ounce three drams.

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The Letter n *refers to the Notes.*

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